Ch 6 Bonding

- Chem Bonding

  Chemical Bond

- Ch 6 Bonding

Chemical Bond - link b/w atoms that Results from a mutual attraction of one atom's nuclei for the other atom's e^- (and vice versa)

- Ch 6 Bonding

Chemical Bond - link b/w atoms that Results from a mutual attraction of one atom's nuclei for the other atom's e⁻ (and vice versa)

Covalent

ionic

- Ch 6 Bonding

Chemical Bond - link b/w atoms that Results from a mutual attraction of one atom's nuclei for the other atom's e⁻ (and vice versa)

Covalent
forms from sharing val e⁻

ionic

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$H^{\cdot} + H^{\cdot} \longrightarrow H:H$

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ionic
link b/c 2 oppositely charged ions attract each other

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$Na^{+} + :\ddot{Cl}:$

- Ch 6 Bonding

Chemical Bond - link b/w atoms that results from a mutual attraction of one atom's nuclei for the other atom's e⁻ (and vice versa)

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forms from sharing val e⁻

$H^{\bullet} + H^{\bullet} \longrightarrow H:H$

ionic
link b/c 2 oppositely charged ions attract each other

$Na^{\bullet} + :\ddot{Cl}: \longrightarrow Na^{+} + :\ddot{Cl}:^{-}$

- Ch 6 Bonding

Chemical Bond - link b/w atoms that Results from a mutual attraction of one atom's nuclei for the other atom's e⁻ (and vice versa)

Covalent
forms from sharing val e⁻

$H^{\cdot} + H^{\cdot} \longrightarrow H:H$

ionic
link b/c 2 oppositely charged ions attract each other

$Na^{\cdot} + :\ddot{Cl}: \longrightarrow Na^{+} + :\ddot{Cl}:^{-}$

ions attract forming a Bond

- Ch 6 Bonding

Chemical Bond - link b/w atoms that Results from a mutual attraction of one atom's nuclei for the other atom's e⁻ (and vice versa)

Covalent (form b/w nonmetals)
forms from sharing val e⁻

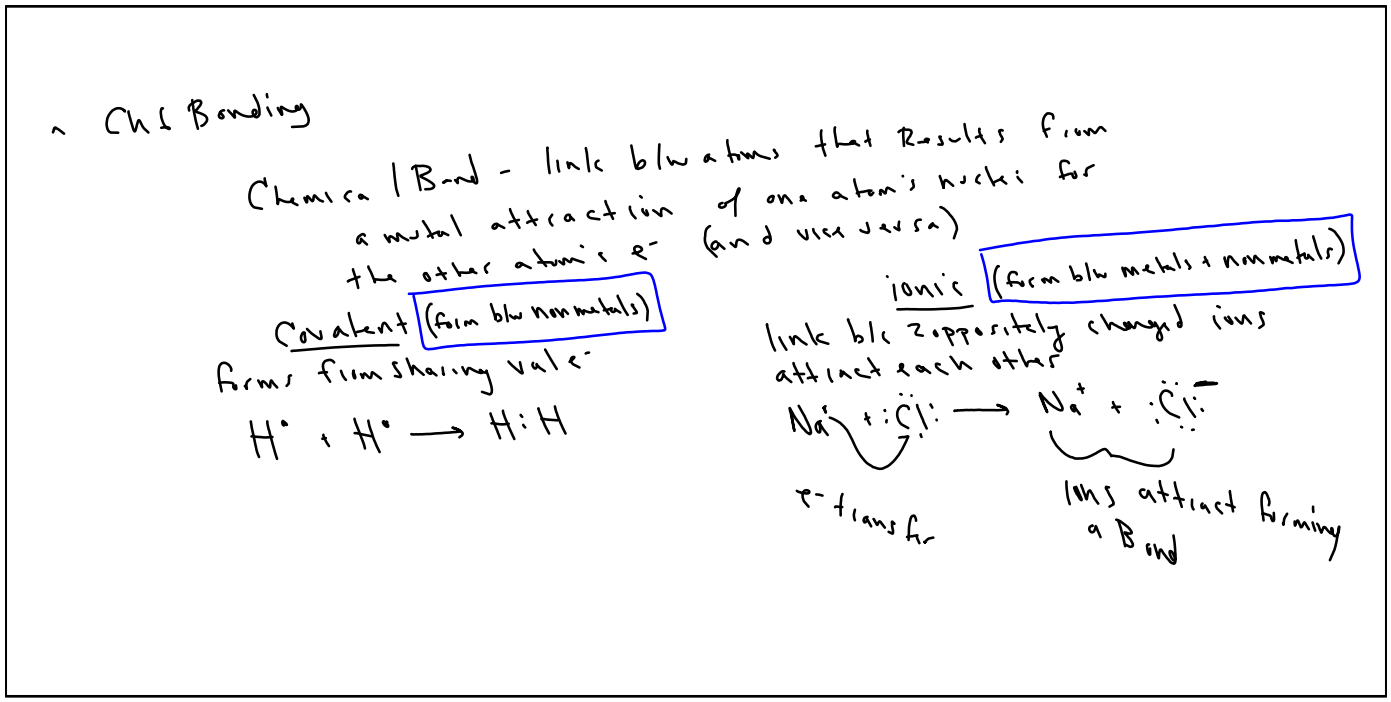
$H^{\cdot} + H^{\cdot} \longrightarrow H:H$

ionic
link b/c 2 oppositely charged ions attract each other

$Na^{\cdot} + :\ddot{Cl}: \longrightarrow Na^{+} + :\ddot{Cl}:^{-}$

e⁻ transfr

Ions attract forming a Bond


Ch 6 Bonding
Chemical Bond - link b/w atoms that Results from a mutual attraction of one atom's nuclei for the other atom's e⁻ (and vice versa)
Covalent (form b/w nonmetals)
forms from sharing val e⁻
H° + H° → H:H
ionic (form b/w metals + nonmetals)
link b/c 2 oppositely charged ions attract each other
Na° + :Cl: → Na⁺ + :Cl:⁻
e⁻ transfr
ions attract forming a Bond

Not every covalent bond will share e⁻ evenly

Not every covalent bond will share e⁻ evenly
↳ how well/evenly e⁻ shared depends on e⁻neg
differences b/w atoms

Not every covalent bond will share e⁻ evenly
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# of difference	Type of difference	Bond Type	Ex

Not every covalent bond will share e⁻ evenly
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# of difference	Type of difference	Bond Type	Ex
	small difference		

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# of difference	Type of difference	Bond Type	Ex
	small difference		H_2

Not every covalent bond will share e⁻ evenly
↳ how well/evenly e⁻ shared depends on e⁻neg differences b/w atoms

# of difference	Type of difference	Bond Type	Ex
	Small difference	Non Polar	H_2

H:H ← same attraction for e⁻ b/w atoms even distribution

Not every covalent bond will share e⁻ evenly
↳ how well/evenly e⁻ shared depends on e⁻neg
differences b/w atoms

#of difference

Type of difference
Small difference
Med diff

Bond Type
Non Polar

Ex
H_2

H:H ← same attraction for e⁻ b/w atoms even distribution

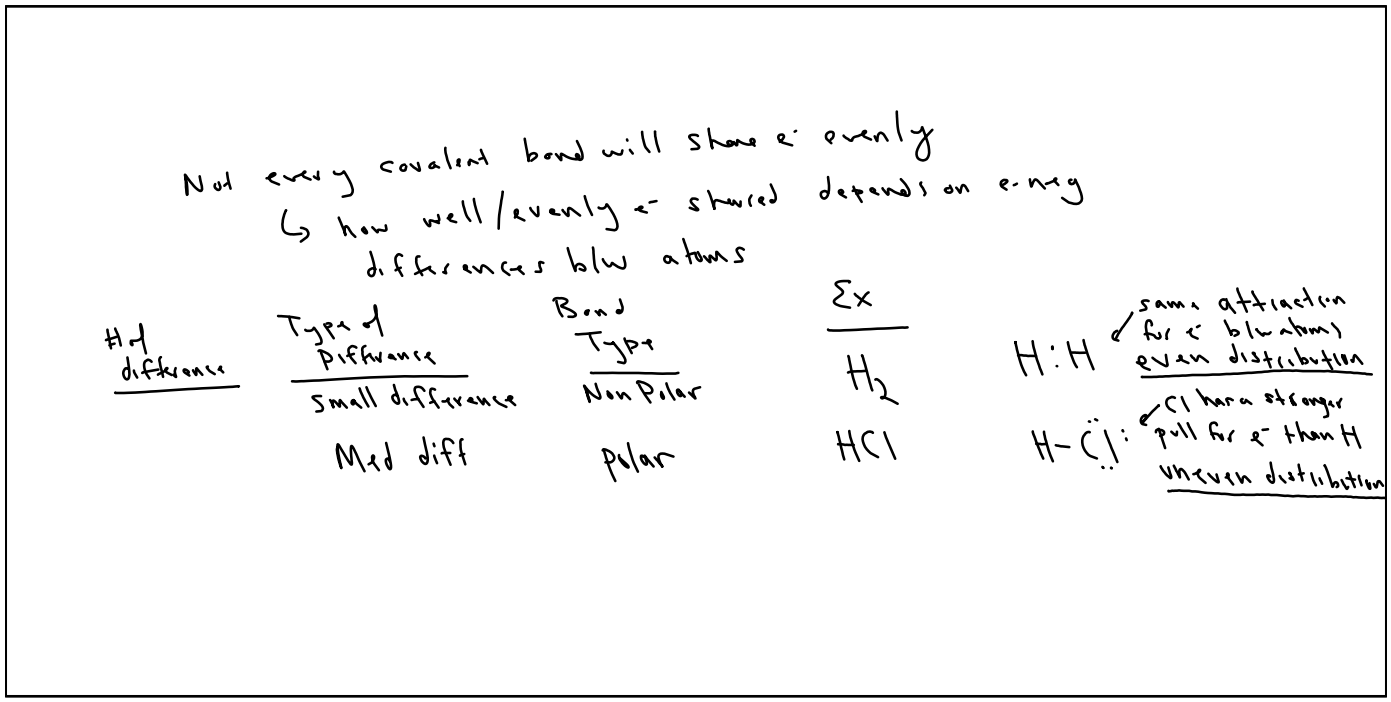
Not every covalent bond will share e⁻ evenly
↳ how well/evenly e⁻ shared depends on e⁻neg differences b/w atoms

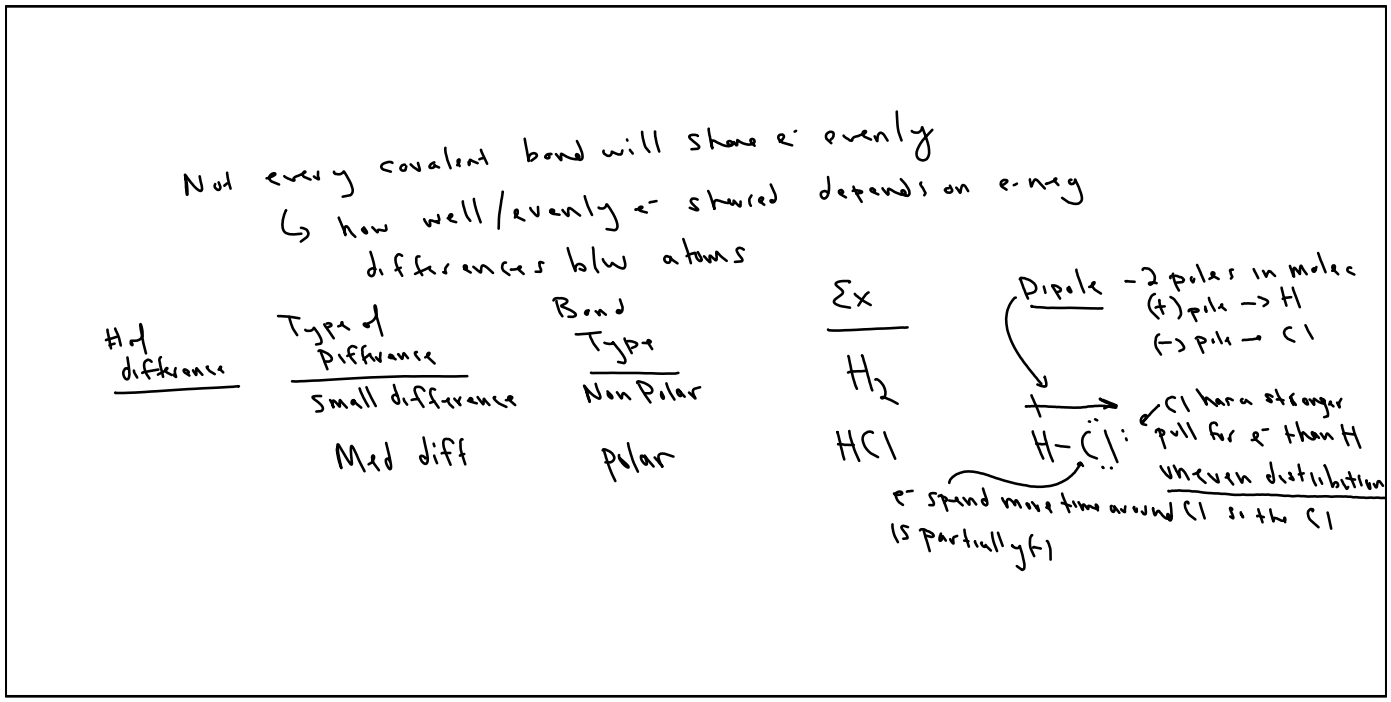
# of difference	Type of difference	Bond Type	Ex
	Small difference	Non Polar	H_2
	Med diff		HCl

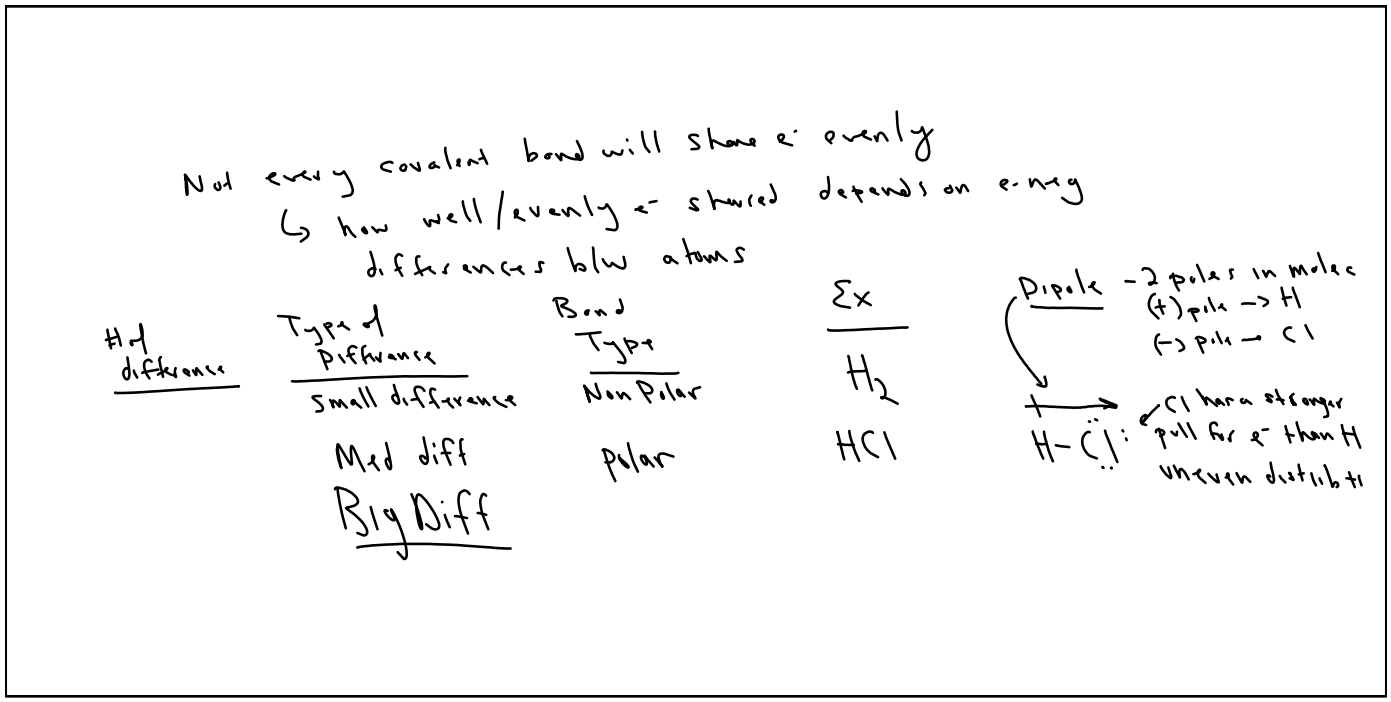
H:H ← same attraction for e⁻ b/w atoms even distribution

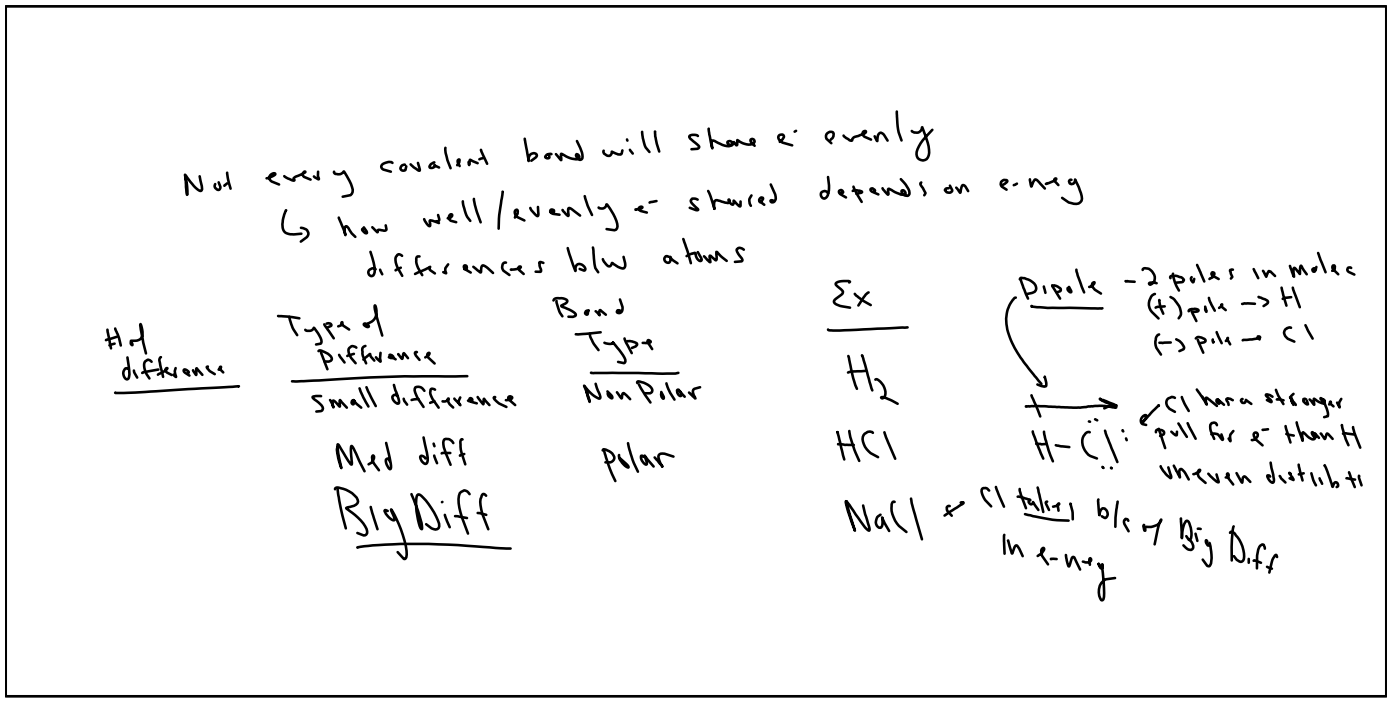
Not every covalent bond will share e⁻ evenly
↳ how well/evenly e⁻ shared depends on e⁻ neg differences b/w atoms

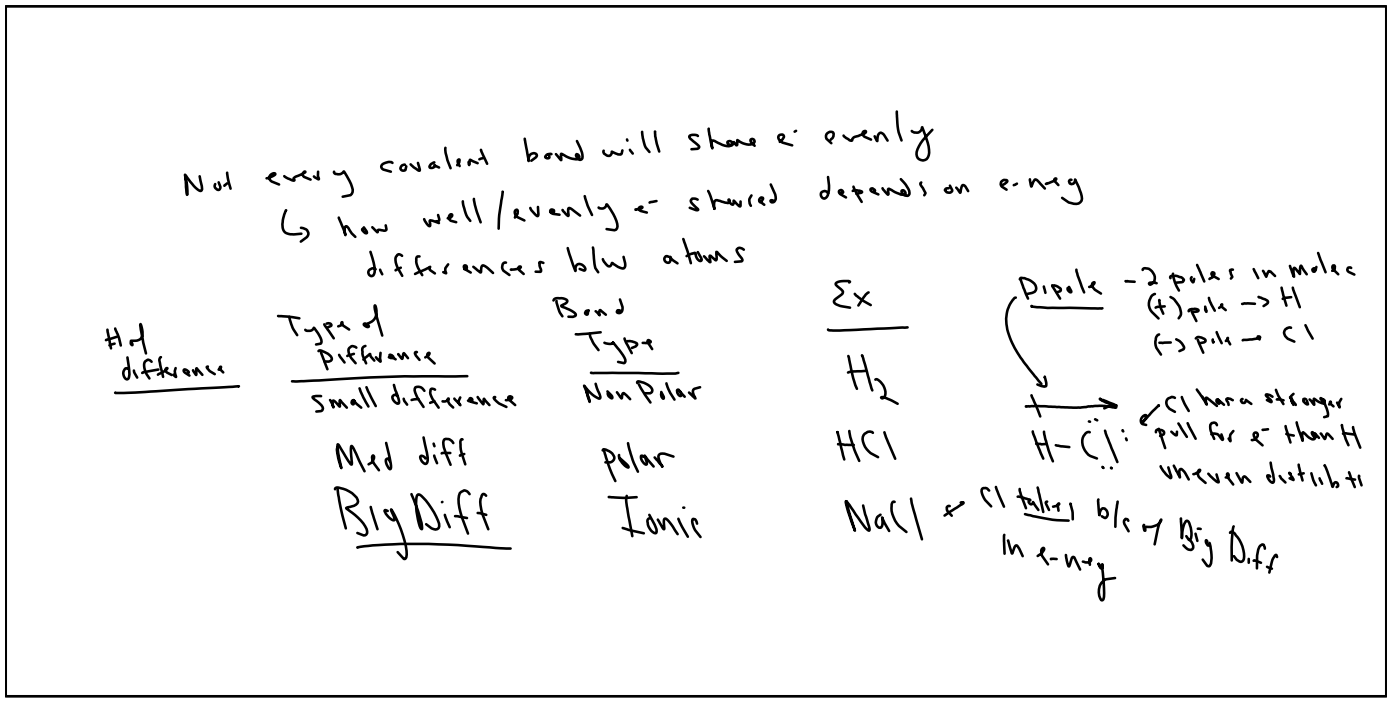
# of difference	Type of difference	Bond Type	Ex	
	Small difference	Non Polar	H_2	H:H ← same attraction for e⁻ b/w atoms even distribution
	Med diff		HCl	H–Cl:

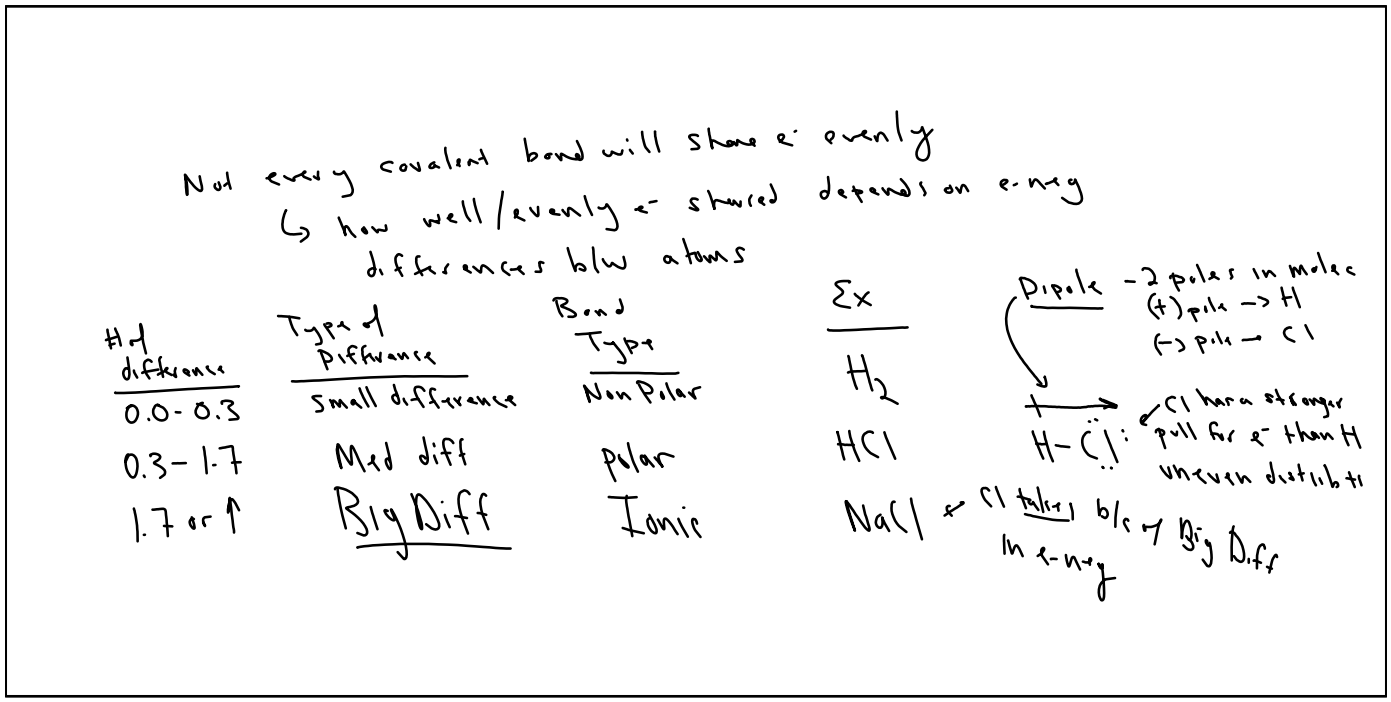

Not every covalent bond will share e⁻ evenly
↳ how well/evenly e⁻ shared depends on e⁻neg differences b/w atoms
# of difference
Type of difference
Bond Type
Ex
Small difference
Non Polar
H₂
same attraction for e⁻ b/w atoms even distribution
Med diff
polar
HCl
Cl has a stronger pull for e⁻ than H uneven distribution


Not every covalent bond will share e⁻ evenly
↳ how well/evenly e⁻ shared depends on e⁻ neg
differences b/w atoms
# of difference
Type of Difference
Small difference
Med diff
Bond Type
Non Polar
Polar
Ex
H2
HCl
Dipole - 2 poles in molec
(+) pole → H
(-) pole → Cl
Cl has a stronger pull for e⁻ than H
uneven distribution
e⁻ spend more time around Cl so the Cl is partially (-)


Not every covalent bond will share e⁻ evenly
↳ how well/evenly e⁻ shared depends on e⁻ neg
differences b/w atoms
#of difference
Type of Difference
Small difference
Med diff
Big Diff
Bond Type
Non Polar
Polar
Ex
H2
HCl
Dipole - 2 poles in molec
(+) pole → H
(-) pole → Cl
Cl has a stronger pull for e⁻ than H
uneven distribution


Not every covalent bond will share e- evenly
↳ how well/evenly e- shared depends on e-neg
differences b/w atoms
# of difference
Type of Difference
Small difference
Med diff
Big Diff
Bond Type
Non Polar
Polar
Ex
H2
HCl
NaCl
Dipole - 2 poles in molec
(+) pole → H
(-) pole → Cl
Cl has a stronger pull for e- than H
uneven distribution
Cl taking b/c of Big Diff in e-neg


Not every covalent bond will share e⁻ evenly
↳ how well/evenly e⁻ shared depends on e-neg
differences b/w atoms
# of difference
Type of Difference
Bond Type
Ex
small difference
Non Polar
H2
Med diff
polar
HCl
Big Diff
Ionic
NaCl
Dipole - 2 poles in molec
(+) pole → H
(-) pole → Cl
Cl has a stronger pull for e⁻ than H
uneven distribution
H-Cl
Cl taken b/c of Big Diff in e-neg


Not every covalent bond will share e⁻ evenly
↳ how well/evenly e⁻ shared depends on e⁻neg
differences b/w atoms
#of difference
0.0 - 0.3
0.3 - 1.7
1.7 or ↑
Type of Difference
Small difference
Med diff
Big Diff
Bond Type
Non Polar
Polar
Ionic
Ex
H2
HCl
NaCl
Dipole - 2 poles in molec
(+) pole → H
(-) pole → Cl
Cl has a stronger pull for e⁻ than H
uneven distribution
Cl takes 1 b/c of Big Diff in e⁻neg

Why do bonds form?

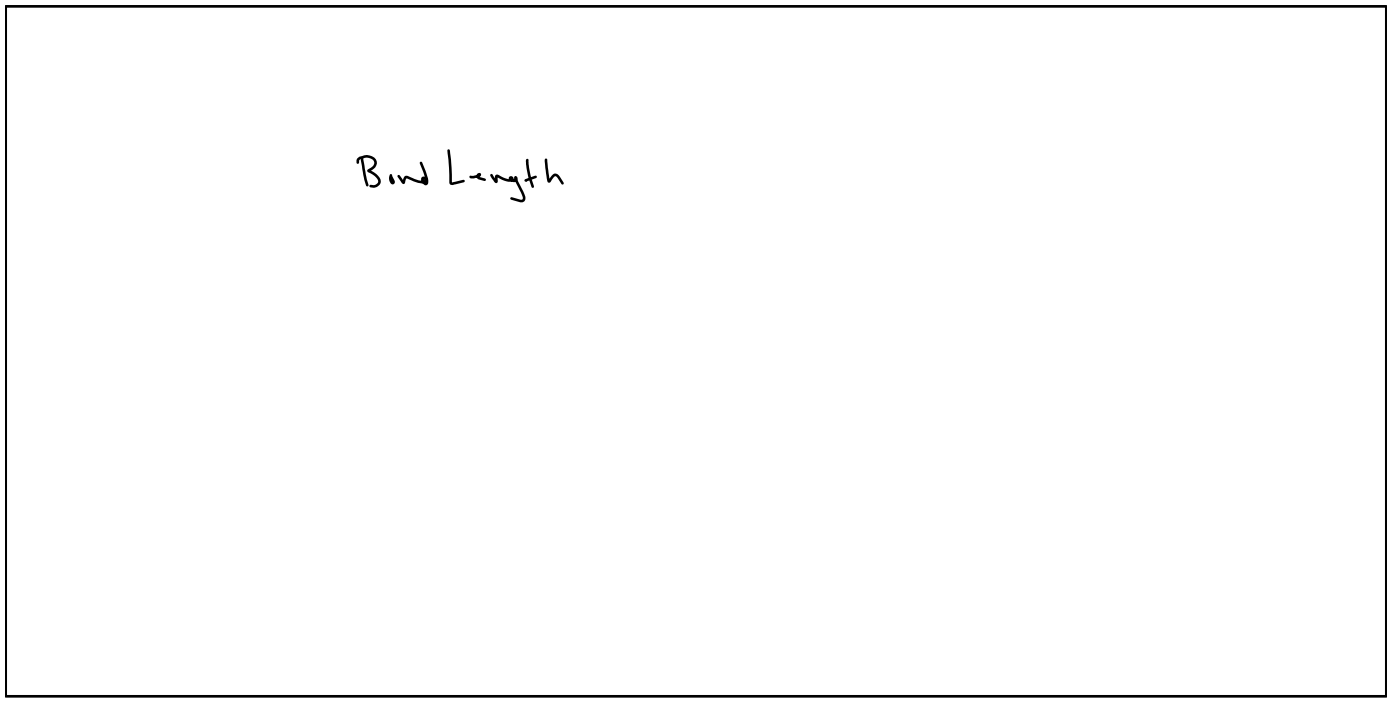
Why do bonds form?

↳ So atoms can be @ the lowest PE possible.

Why do bonds form?

↳ So atoms can be @ the lowest PE possible.

↳ atoms are stable w/ a full outer shell of e⁻


Bird Length

Bond Length - dist b/w the nuclei of 2 bonded atoms

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Bond Energy -

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Bond Energy - E req'd to break a chemical bond.

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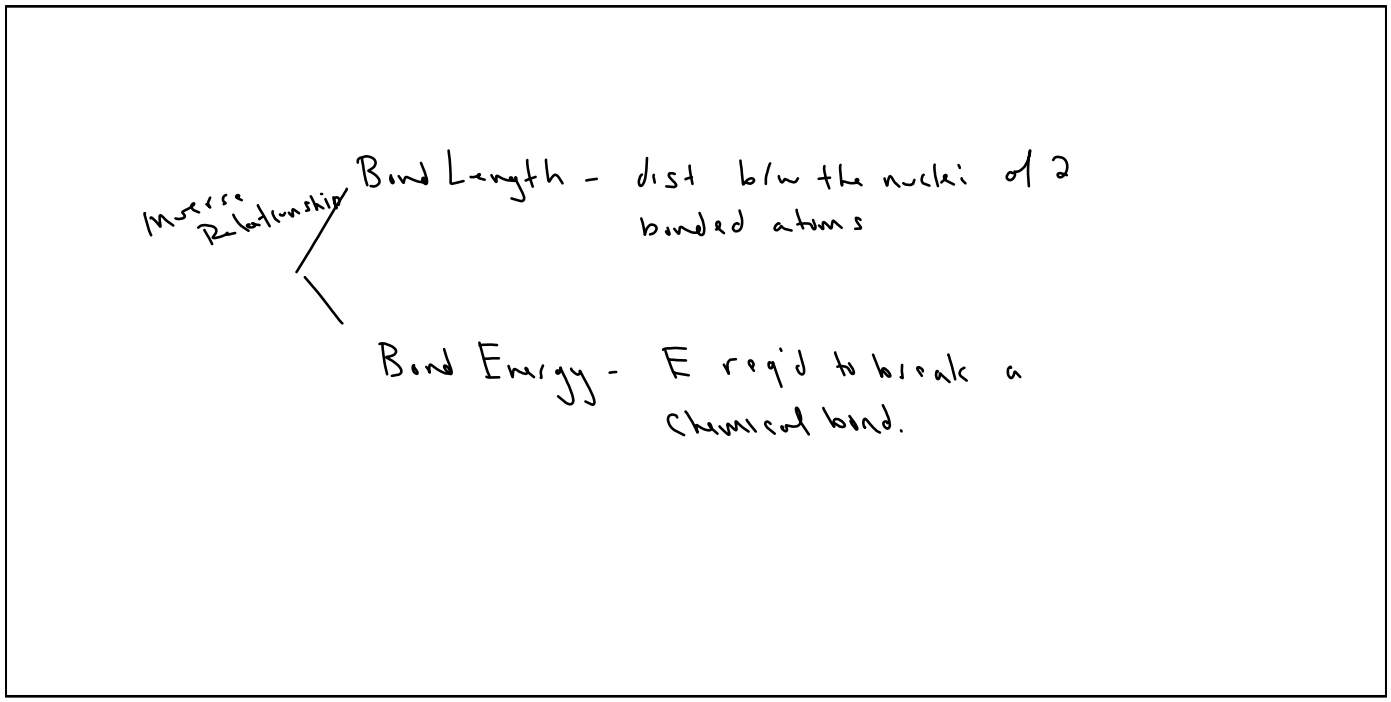

Inverse Relationship
Bond Length - dist b/w the nuclei of 2 bonded atoms
Bond Energy - E req'd to break a chemical bond.

Inverse Relationship

Bond Length - dist b/w the nuclei of 2 bonded atoms

BL ↓, BF ↑

Bond Energy - E req'd to break a chemical bond.

Showing x-rules of Molecules

Showing x-rules of Molecules
(structures)
↳ pictorally covalent bonds

Showing x-tures of Molecules (Lewis x-tures)
(structures)
↳ pictorally covalent bonds

Octet Rule - atoms form bonds by gaining, losing, or sharing e⁻
to get 8 e⁻ in their outermost shell

Showing structures of Molecules (Lewis structures)

↳ pictorially covalent bonds

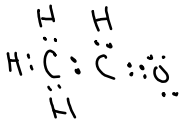
Octet Rule - atoms form bonds by gaining, losing, or sharing e^- to get 8 e^- in their outermost shell

Ex: H:H H:C⋮⋮N:

Showing structures of Molecules (Lewis structures)

↳ pictorially covalent bonds

Octet Rule - atoms form bonds by gaining, losing, or sharing e^- to get 8 e^- in their outermost shell

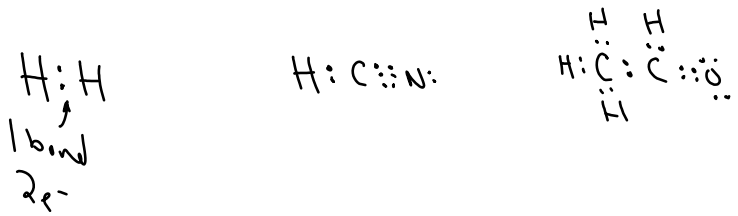
Ex: $H:H$ $H:C:::N:$ 

Showing structures of Molecules (Lewis structures)

↳ pictorially covalent bonds

Octet Rule - atoms form bonds by gaining, losing, or sharing e^- to get 8 e^- in their outermost shell

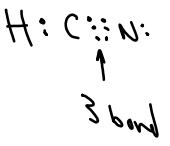
Ex:

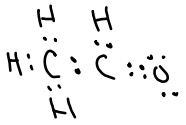


Showing x-tures of Molecules (Lewis x-tures)
(structures)
↳ pictorially covalent bonds

Octet Rule - atoms form bonds by gaining, losing, or sharing e⁻ to get 8 e⁻ in their outermost shell

Ex:



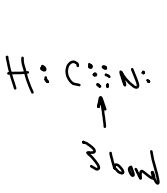


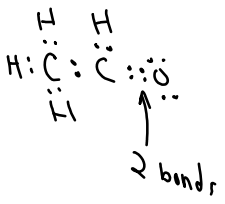
Showing structures of Molecules (Lewis structures)

↳ pictorially covalent bonds

Octet Rule - atoms form bonds by gaining, losing, or sharing e^- to get 8 e^- in their outermost shell

Ex:



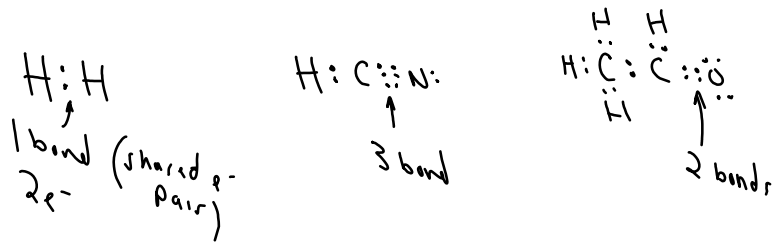


Showing structures of Molecules (Lewis structures)

↳ pictorially covalent bonds

Octet Rule - atoms form bonds by gaining, losing, or sharing e⁻ to get 8 e⁻ in their outermost shell

Ex:



Showing structures of Molecules (Lewis structures)

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Octet Rule - atoms form bonds by gaining, losing, or sharing e⁻ to get 8 e⁻ in their outermost shell

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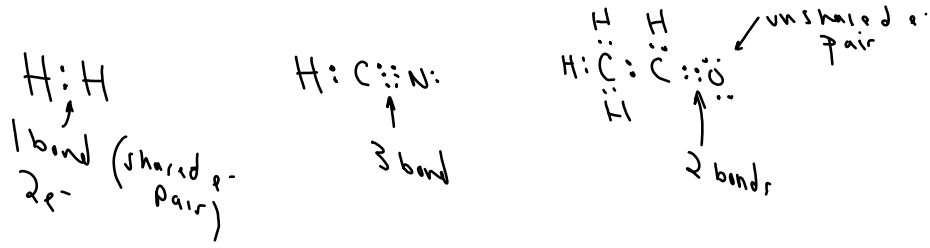


Draw the structure of Iodomethane

Steps to Draw Lewis Structures

Draw the structure of Iodomethane

CH_3I

Steps to Draw Lewis structures

1. Find the total # of valence e⁻ in the molecule

Draw the structure of Iodomethane

CH_3I

Steps to Draw Lewis Structures

1. Find the total # of valence e⁻ in the molecule, convert to e⁻ pairs

Draw the structure of Iodomethane

CH_3I

Steps to Draw Lewis Structures

1. Find the total # of valence e⁻ in the molecule, convert to e⁻ pairs

C: 1 × 4 valence = 4 valence

Draw the structure of Iodomethane

CH_3I

Steps to Draw Lewis x-tures

1. Find the total # valence e⁻ in the molecule, convert to e⁻ pairs

C: 1 x 4 val e⁻ = 4 val e⁻

H: 3 x 1 val e⁻ = 3 val e⁻

Draw the xture of Iodomethane

CH_3I

Steps to Draw Lewis Structures

1. Find the total # of valence e⁻ in the molecule, convert to e⁻ pairs

C : 1 x 4 valence = 4 valence

H : 3 x 1 valence = 3 valence

I : 1 x 7 valence =

Draw the structure of Iodomethane

CH_3I

Steps to Draw Lewis structures

1. Find the total # of valence e⁻ in the molecule, convert to e⁻ pairs

C: 1 × 4 val e⁻ = 4 val e⁻
H: 3 × 1 val e⁻ = 3 val e⁻
I: 1 × 7 val e⁻ = 7 val e⁻
14 val e⁻ 7 e⁻ pairs

Draw the structure of Iodomethane

CH_3I

Steps to Draw Lewis structures

1. Find the total # valence e⁻ in the molecule, convert to e⁻ pairs [7 e⁻ pairs] Draw the structure of Iodomethane

CH_3I

C : 1 × 4 valence e⁻ = 4 valence e⁻

H : 3 × 1 valence e⁻ = 3 valence e⁻

I : 1 × 7 valence e⁻ = 7 valence e⁻

[14 valence e⁻ 17 e⁻ pairs]

Steps to Draw Lewis Structures

1. Find the total # of valence e⁻ in the molecule, convert to e⁻ pairs [7 e⁻ pairs] Draw the structure of Iodomethane

CH_3I

2. Arrange atoms in a simple layout

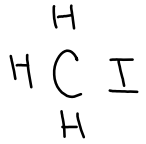
[C always in middle
H Never in middle]

Steps to Draw Lewis Structures

1. Find the total # of valence e- in the molecule, convert to e- pairs [7 e- pairs] Draw the structure of Iodomethane

CH_3I

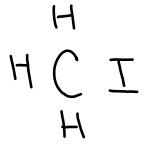
2. Arrange atoms in a simple layout
   - C always in middle
   - H Never in middle



Steps to Draw Lewis x-tures

1. Find the total # of valence e⁻ in the molecule, convert to e⁻ pairs [7 e⁻ pairs] Draw the x-ture of Iodomethane
2. Arrange atoms in a simple layout
3. a. Put e⁻ pairs b/w atoms to bind them

CH_3I



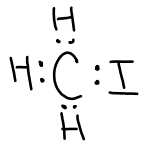
Steps to Draw Lewis Structures

1. Find the total # of valence e⁻ in the molecule, convert to e⁻ pairs [7 e⁻ pairs] Draw the structure of Iodomethane

2. Arrange atoms in a simple layout

3a. Put e⁻ pairs b/w atoms to bind them

CH_3I



Steps to Draw Lewis Structures

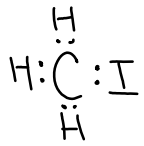
1. Find the total # of valence e⁻ in the molecule, convert to e⁻ pairs [7 e⁻ pairs] Draw the structure of Iodomethane

CH_3I

2. Arrange atoms in a simple layout

3a. Put e⁻ pairs b/w atoms to bind them (shared)

b. Put e⁻ pairs around each nonmetal to give them an octet. (Except H)



Steps to Draw Lewis Structures

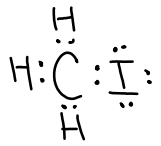
1. Find the total # of valence e⁻ in the molecule, convert to e⁻ pairs [7 e⁻ pairs] Draw the structure of Iodomethane

CH_3I

2. Arrange atoms in a simple layout

3a. Put e⁻ pairs b/w atoms to bind them (unshared)

b. Put e⁻ pairs around each nonmetal to give them an octet. (Except H)



Steps to Draw Lewis Structures

1. Find the total # of valence e⁻ in the molecule, convert to e⁻ pairs [7 e⁻ pairs] Draw the structure of Iodomethane

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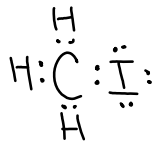


4. Check Math!

Steps to Draw Lewis Structures

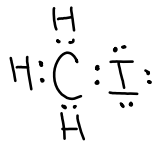
1. Find the total # of valence e⁻ in the molecule, convert to e⁻ pairs [7 e⁻ pairs] Draw the structure of Iodomethane

CH_3I

2. Arrange atoms in a simple layout

3a. Put e⁻ pairs b/w atoms to bind them (shared)

b. Put e⁻ pairs around each nonmetal to give them an octet. (Except H)



4. Check Math! If too many e⁻ in structure put in multiple bonds

Steps to Draw Lewis Structures

1. Find the total # of valence e⁻ in the molecule, convert to e⁻ pairs — 7 e⁻ pairs

2. Arrange atoms in a simple layout

3a. Put e⁻ pairs b/w atoms to bind them

b. Put rest of e⁻ pairs around each nonmetal to give them an octet. (Except H)

4. Check Math! If too many e⁻ in Xture put in multiple bonds

NH_3

Steps to Draw Lewis Structures

1. Find the total # of valence e⁻ in the molecule, convert to e⁻ pairs — 7 e⁻ pairs

2. Arrange atoms in a simple layout

3a. Put e⁻ pairs b/w atoms to bind them

b Put e⁻ pairs around each nonmetal (unshared) to give them an octet. (Except H)

4. Check Math! If too many e⁻ in Xture put in multiple bonds

NH_3

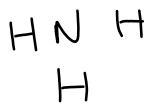
NH_3

NH_3 N

4 e⁻ pairs

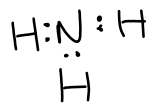
NH_3

4 e⁻ pairs



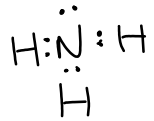
NH_3

4 e⁻ pairs



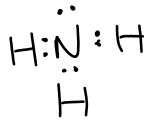
NH_3

4 e⁻ pairs



NH_3

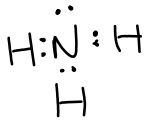
4 e⁻ pairs



C_2H_6

NH_3

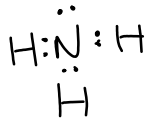
4 e⁻ pairs



C_2H_6

14 e⁻ 7 e⁻ pairs

NH_3



4 e⁻ pairs

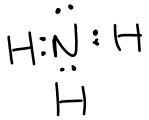
C_2H_6

C C

14 e⁻ 7 e⁻ pairs

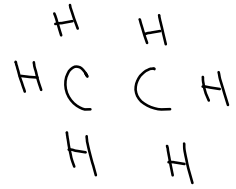
NH_3

4 e⁻ pairs



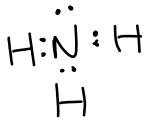
C_2H_6

14 e⁻ 7 e⁻ pairs



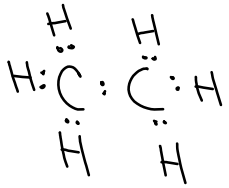
NH_3

4 e⁻ pairs



C_2H_6

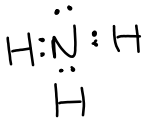
14 e⁻ 7 e⁻ pairs



CH_2O

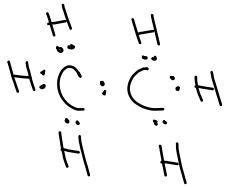
NH_3

4 e⁻ pairs



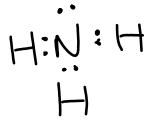
C_2H_6

14 e⁻ 7 e⁻ pairs



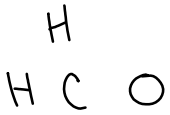
NH_3

$4e^-$ pairs



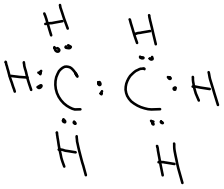
CH_2O

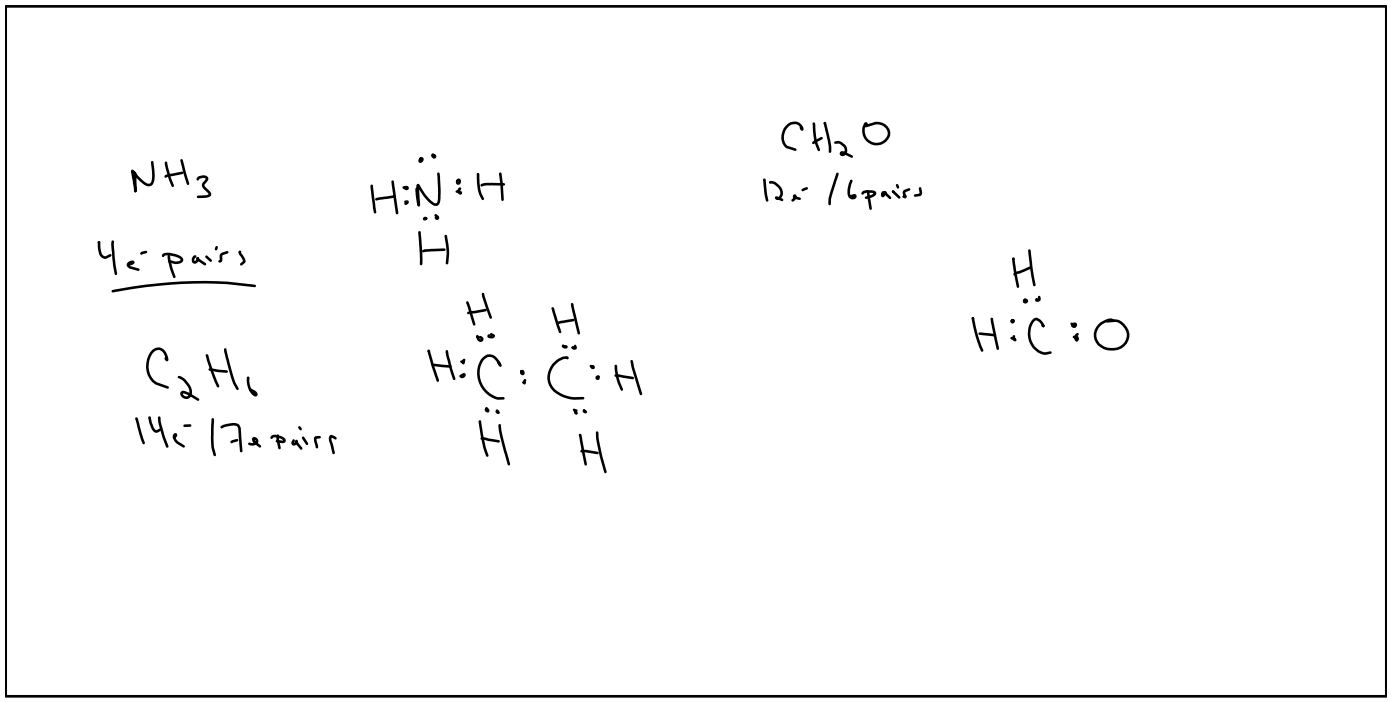
$12e^-$ / 6 pairs



C_2H_6

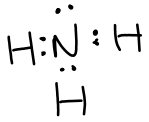
$14e^-$ / 7 pairs




NH3
4e- pairs
C2H6
14e- 7 pairs
CH2O
12e- / 6 pairs

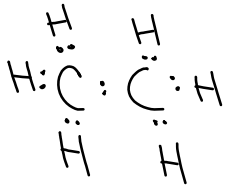
NH_3

4 e⁻ pairs



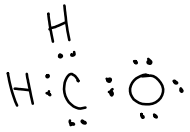
C_2H_6

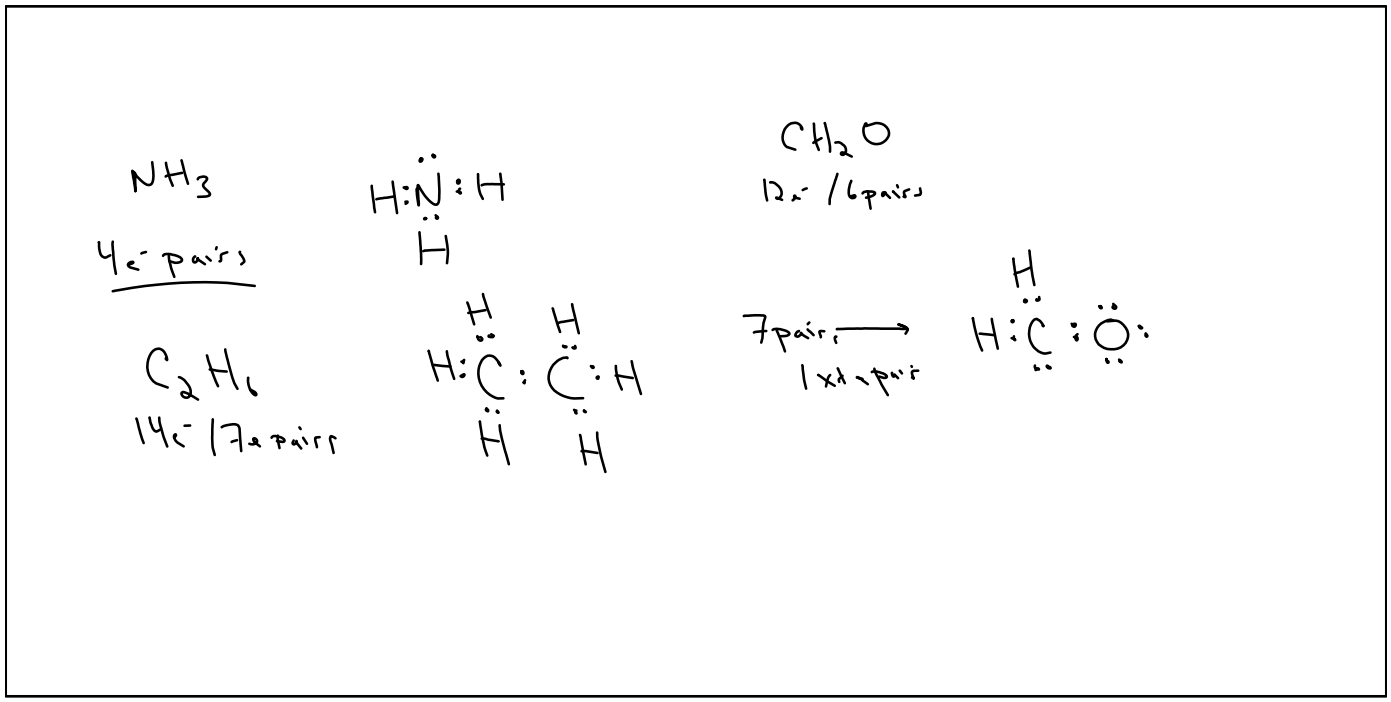
14 e⁻ / 7 e⁻ pairs



CH_2O

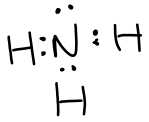
12 e⁻ / 6 pairs




NH3
4e- pairs
C2H6
14e- 7e pairs
CH2O
12e- / 6pairs
7pairs
1x4-pair

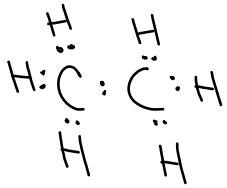
NH_3

8 e⁻ pairs



C_2H_6

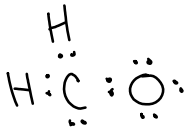
14 e⁻ / 7 e⁻ pairs



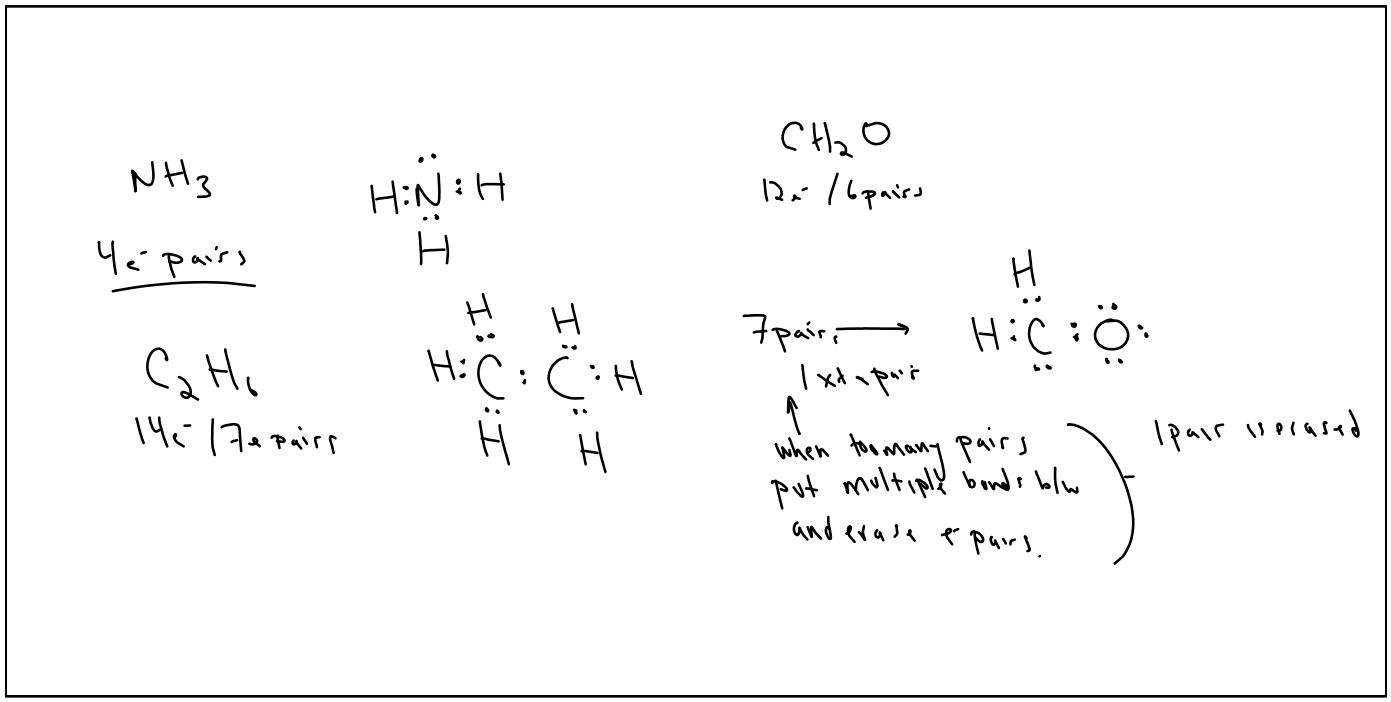
CH_2O

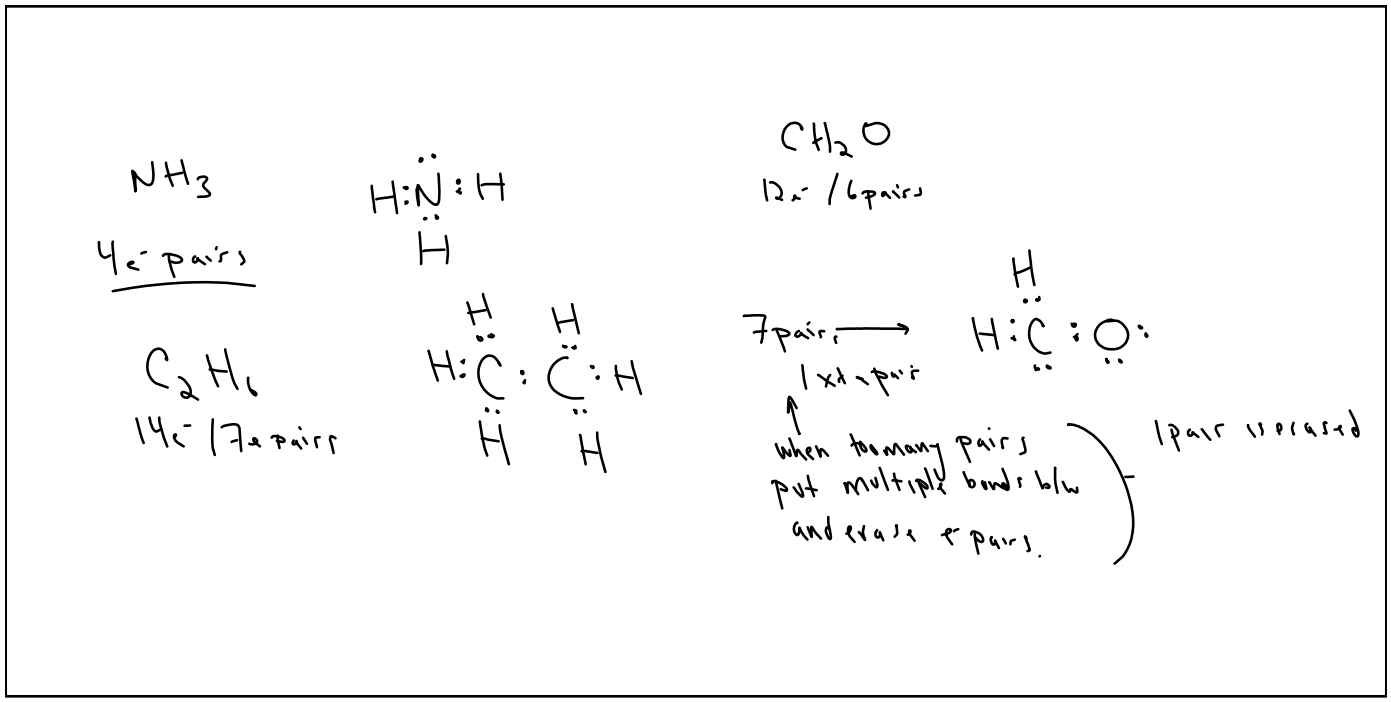
12 e⁻ / 6 pairs

7 pairs ⟶ 1 extra pair



↑ when too many pairs put multiple bonds b/w and erase e⁻ pairs.


NH3
4e- pairs
C2H6
14e- 7e pairs
CH2O
12e- / 6pairs
7pairs
1xtra pair
when too many pairs put multiple bonds b/w and erase e- pairs.
1pair removed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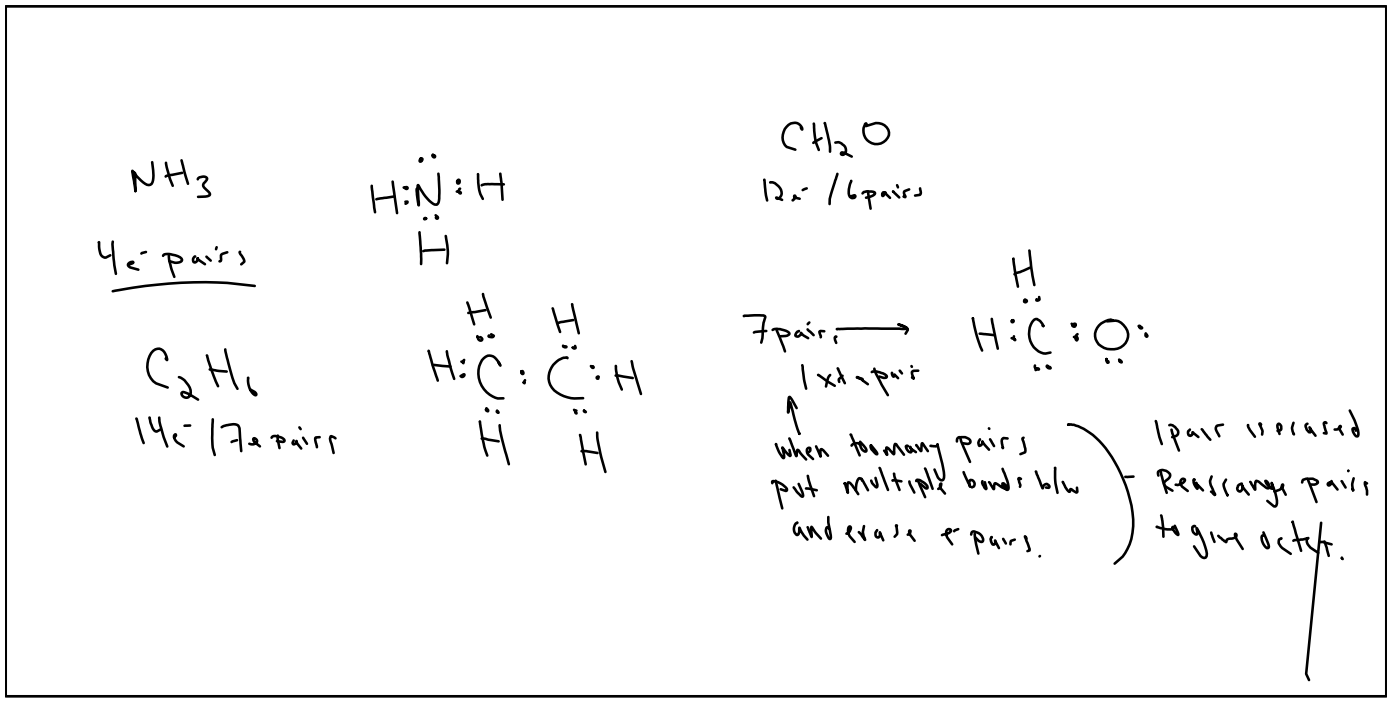
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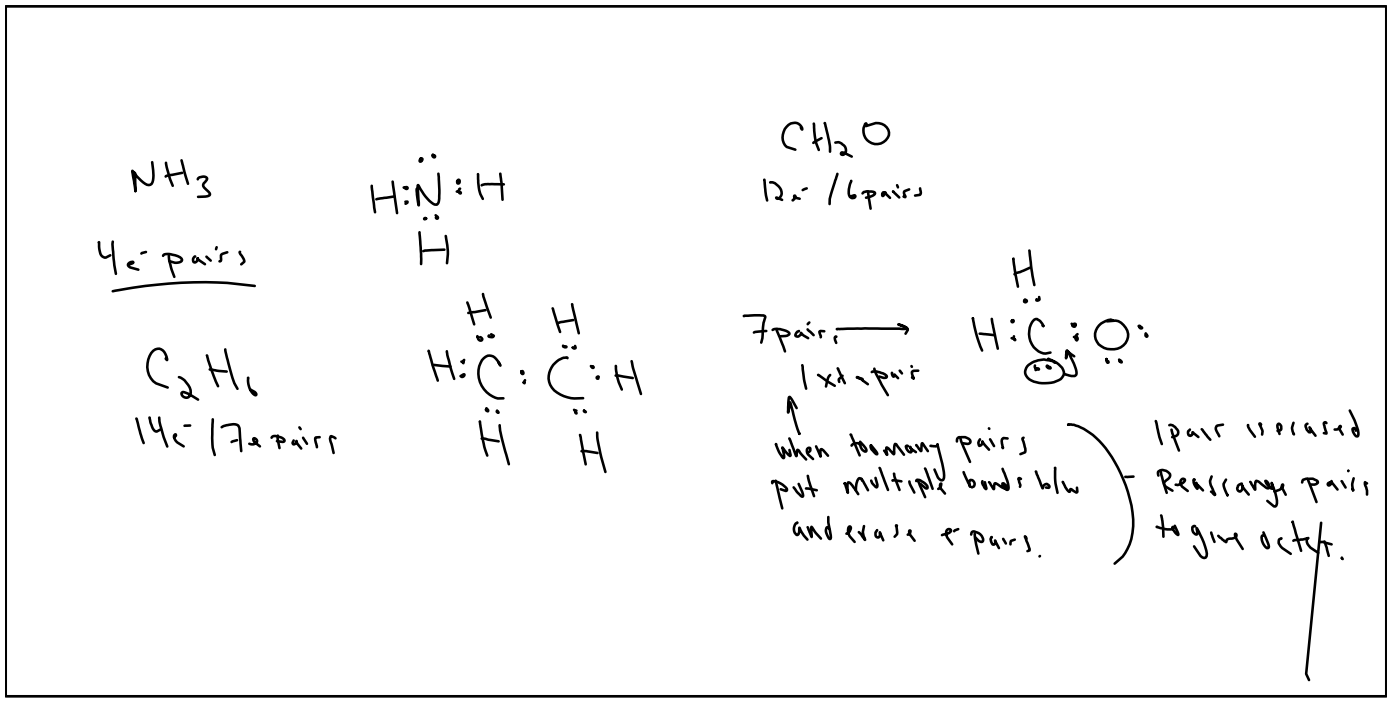
1pair is erased
Rearrange pairs to give octet.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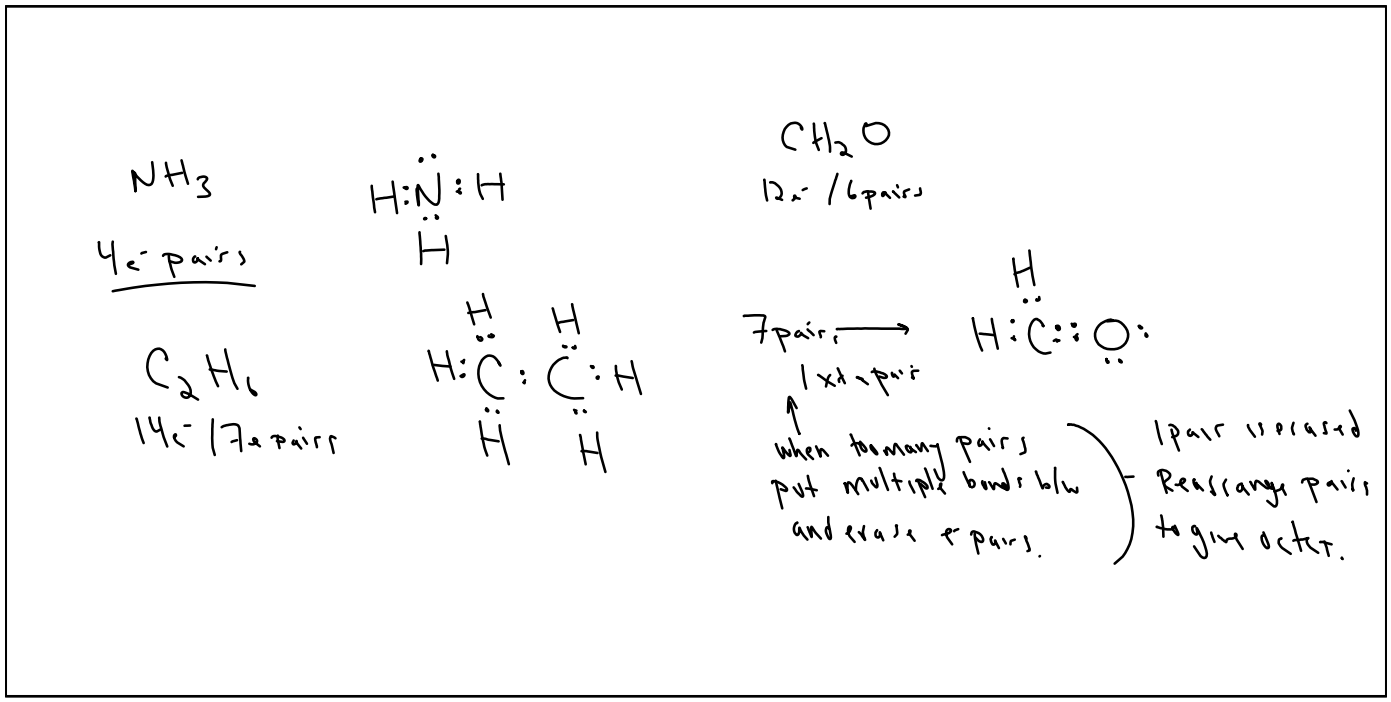
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Ions + Structure

Ions + Structure

OH^-

NH_4^+

Ions + Structure

OH^-

NH_4^+

Ions + Structure

OH^-

O – 6 val e⁻
H – 1 val e⁻
7 val e⁻
charge –1 + 1 e⁻
8 e⁻

NH_4^+

Ions + Structure

OH^-

O – 6 val e⁻
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O H

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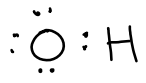

NH_4^+

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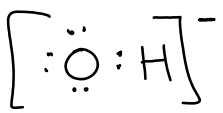

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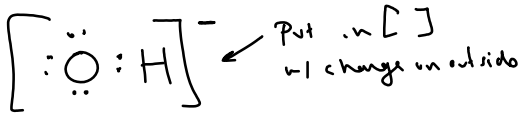


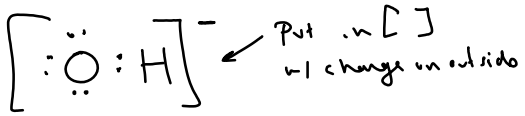
NH_4^+

Ions + Structure

OH^-

O – 6 vale⁻
H – 1 vale⁻
7 vale⁻
charge –1 + 1 e⁻
8 e⁻

NH_4^+

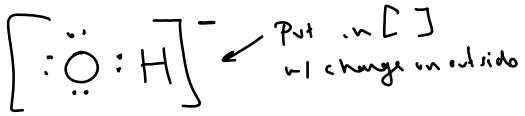


Ions + Structure

OH^-

O – 6 val e⁻
H – 1 val e⁻
7 val e⁻
charge –1 +1 e⁻
8 e⁻

NH_4^+ N – 5 val e⁻



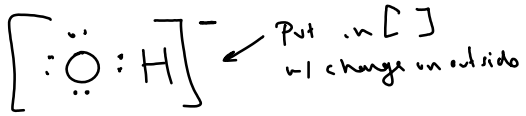
Ions + Structure

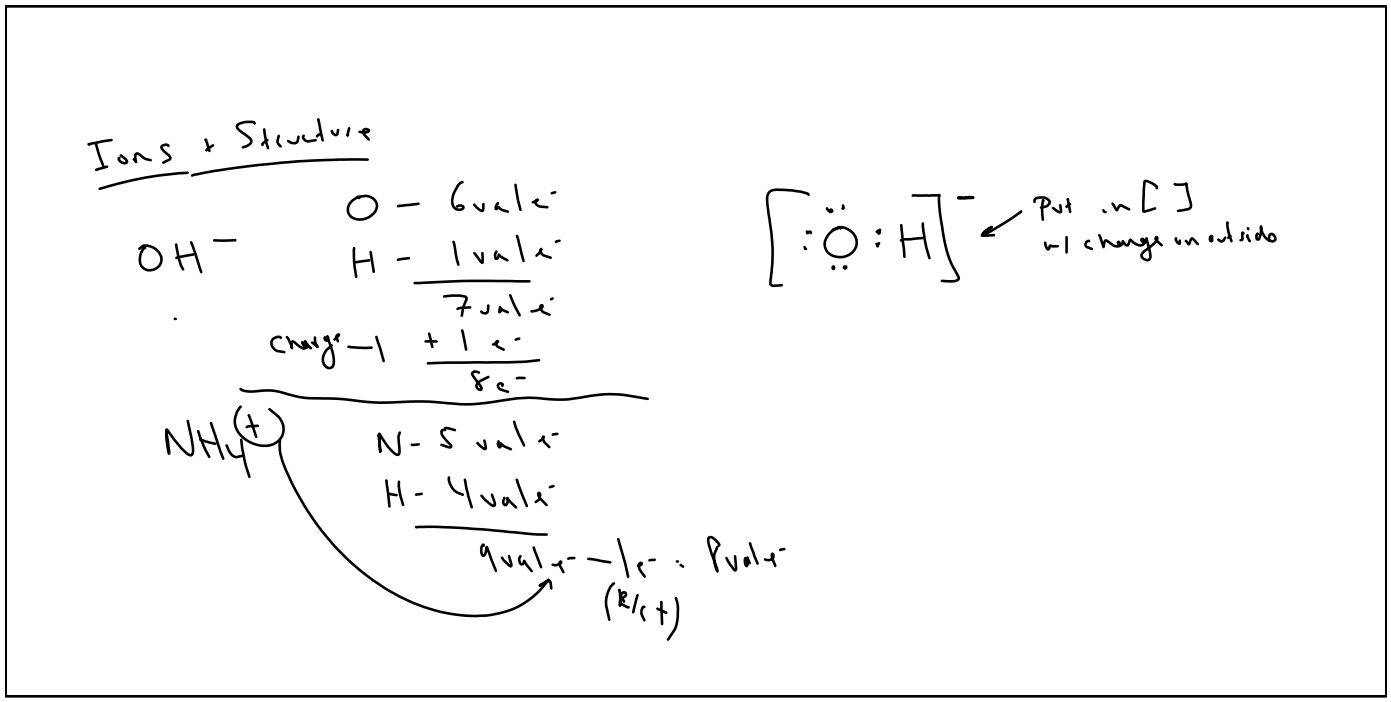
OH^-

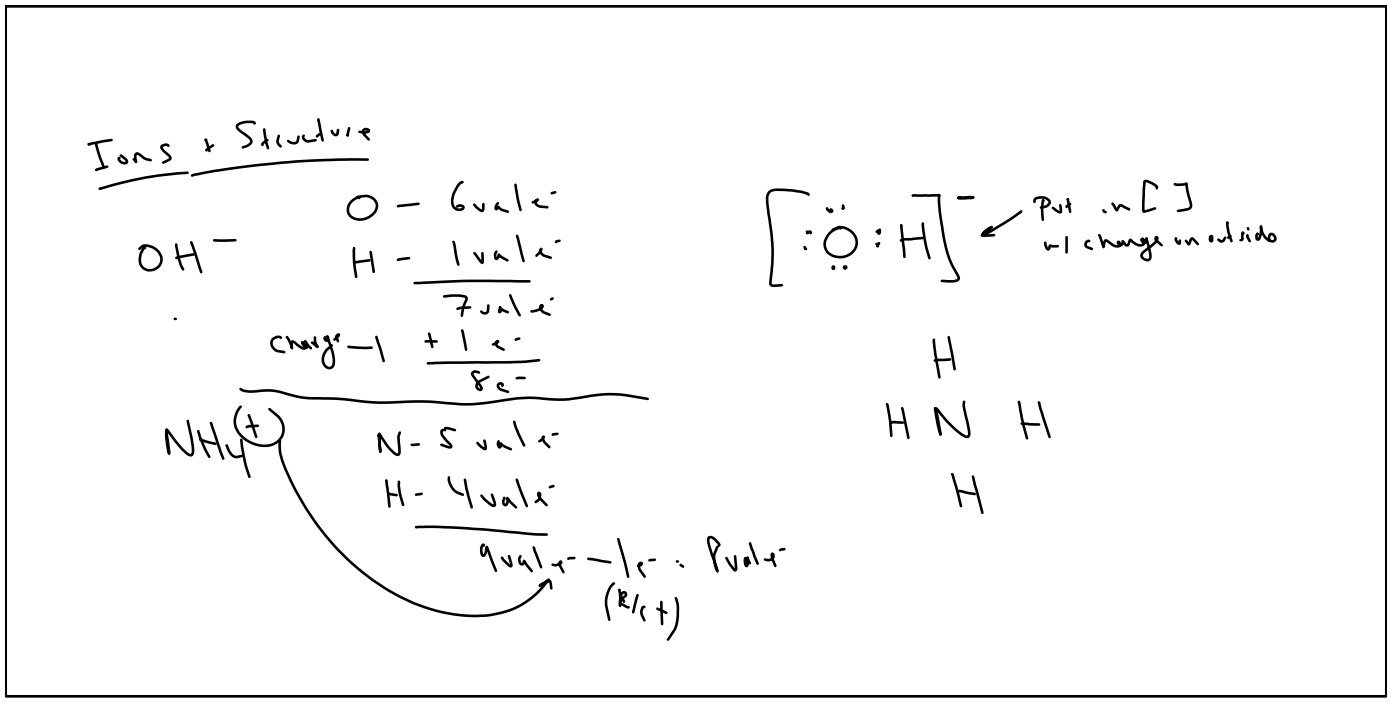
O – 6 val e⁻
H – 1 val e⁻
7 val e⁻
charge –1 + 1 e⁻
8 e⁻

NH_4^+

N – 5 val e⁻
H – 4 val e⁻
9 val e⁻




Ions + Structure
OH⁻
O - 6 val e⁻
H - 1 val e⁻
7 val e⁻
charge -1 + 1 e⁻
8 e⁻
NH4 (+)
N - 5 val e⁻
H - 4 val e⁻
9 val e⁻ - 1 e⁻ : P val e⁻
(R/(+)
Put in [ ]
w/ charge on outside


Ions + Structure
OH⁻
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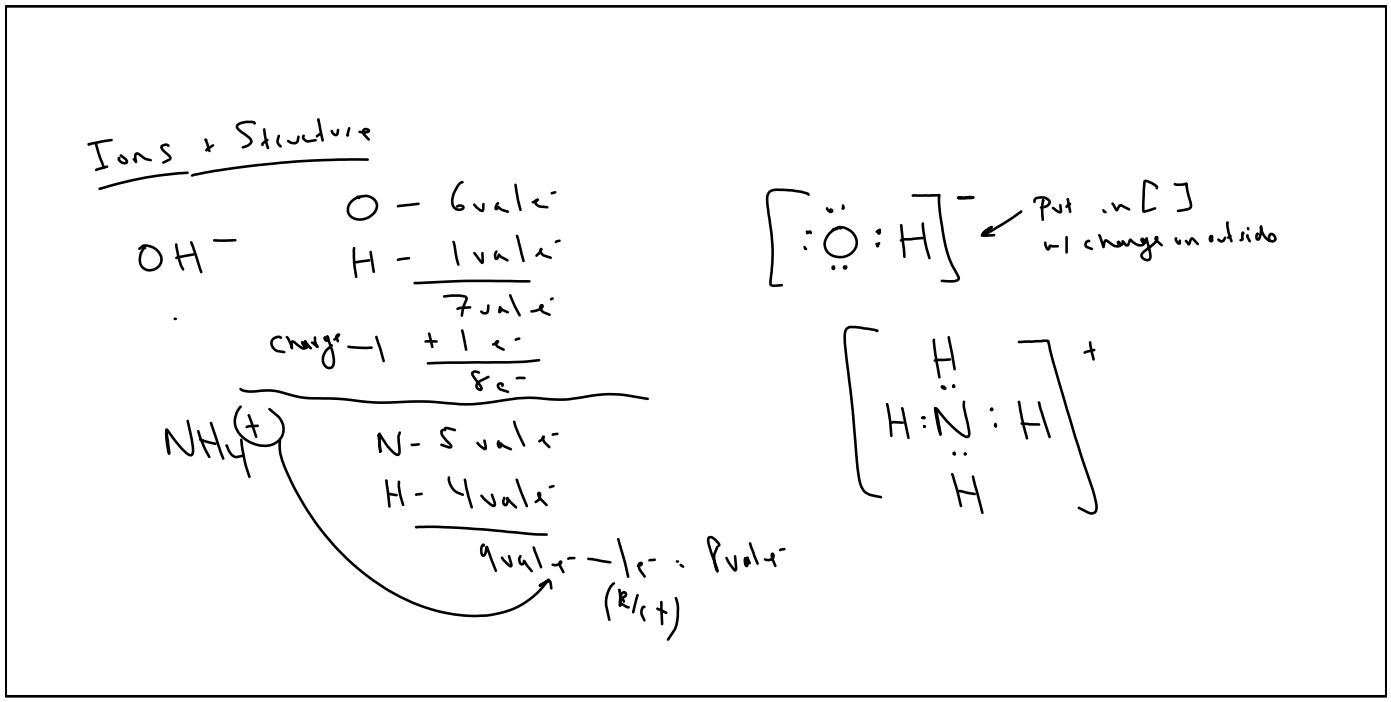
NH4 (+)
N - 5 val e⁻
H - 4 val e⁻
9 val e⁻ - 1 e⁻ : P val e⁻
(R/(+)
Put in [ ] w/ charge on outside
H
H N H
H


Ions + Structure
OH⁻
O - 6 val e⁻
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NH4 (+)
N - 5 val e⁻
H - 4 val e⁻
9 val e⁻ - 1 e⁻ = 8 val e⁻
(R/(+)
Put in [ ]
w/ charge on outside

Ionic Bonding

Ionic Bonding - link b/w 2 oppositely charged ions
↳ form b/w metals + nonmetals

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Na· ·· :I: ··

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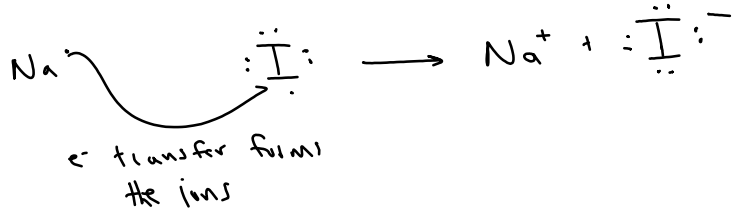

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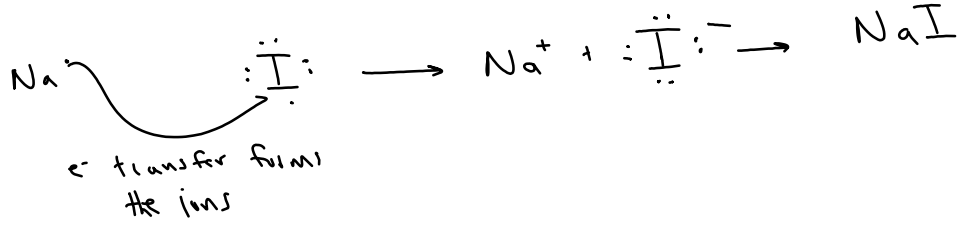
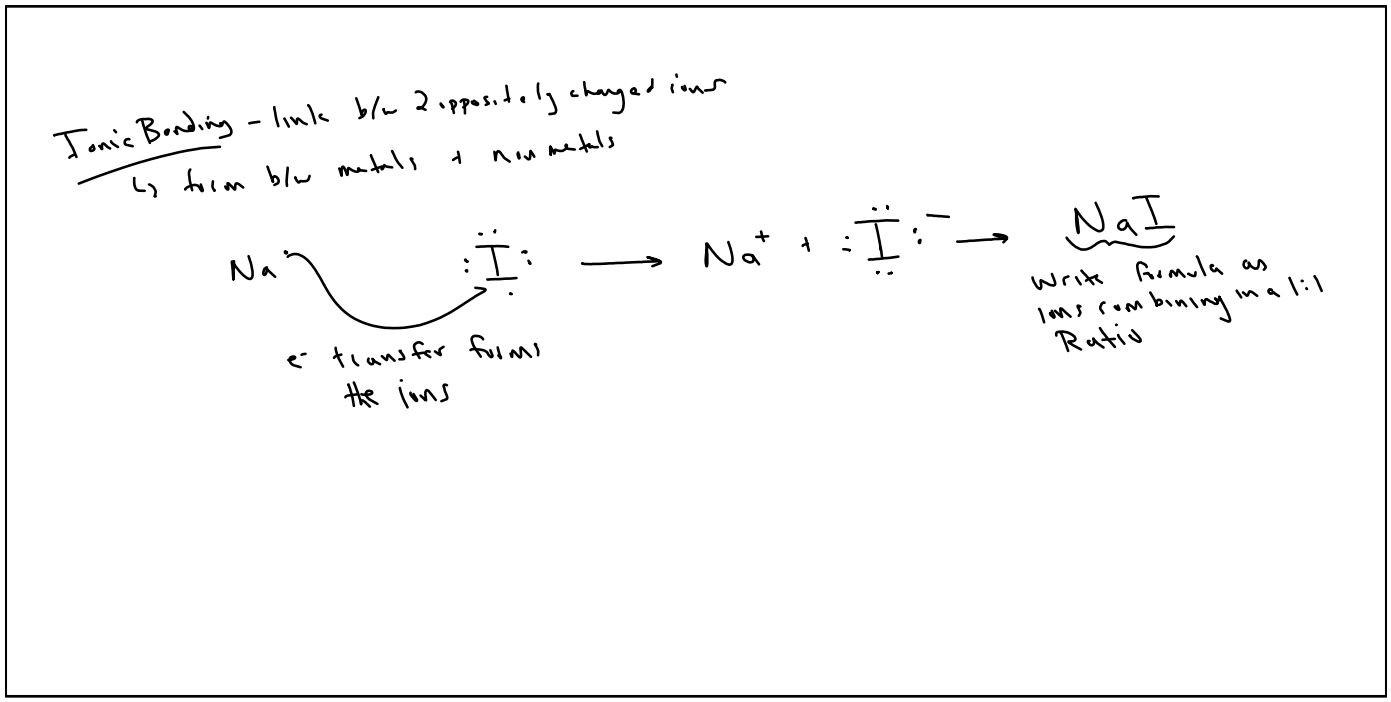
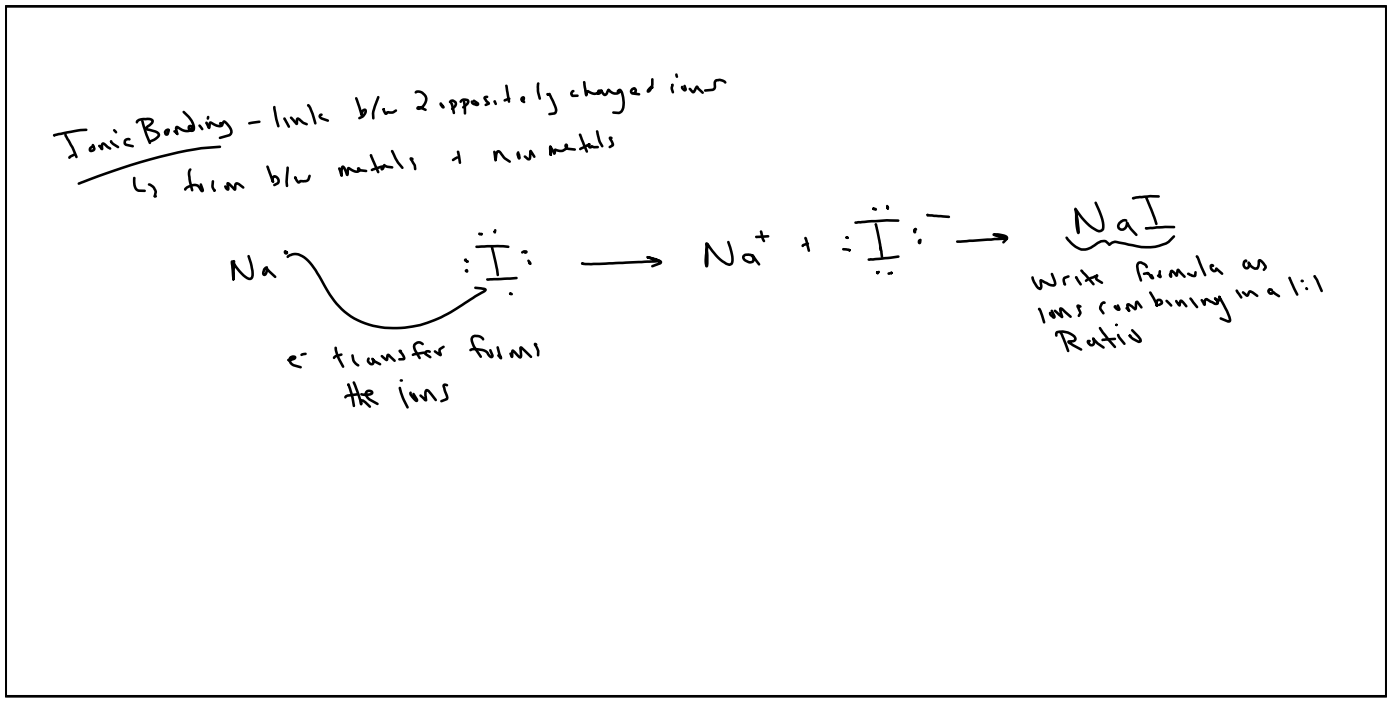



Ionic Bonding - link b/w 2 oppositely charged ions
by from b/w metals + nonmetals
Na
I
e- transfer forms the ions
Na+ + I-
NaI
Write formula as ions combining in a 1:1 Ratio


Ionic Bonding - link b/w 2 oppositely charged ions
↳ form b/w metals + nonmetals
Na
:I:
Na+ + :I:−
NaI
Write formula as ions combining in a 1:1 Ratio
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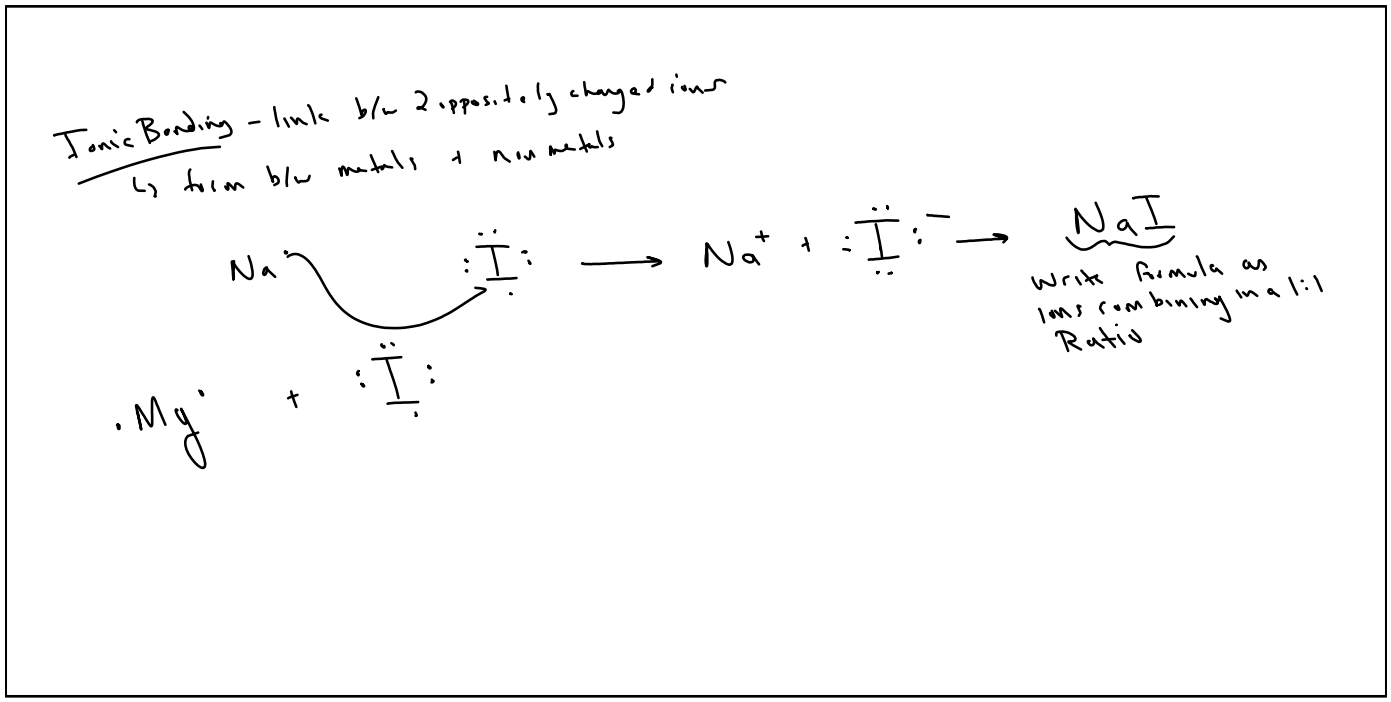
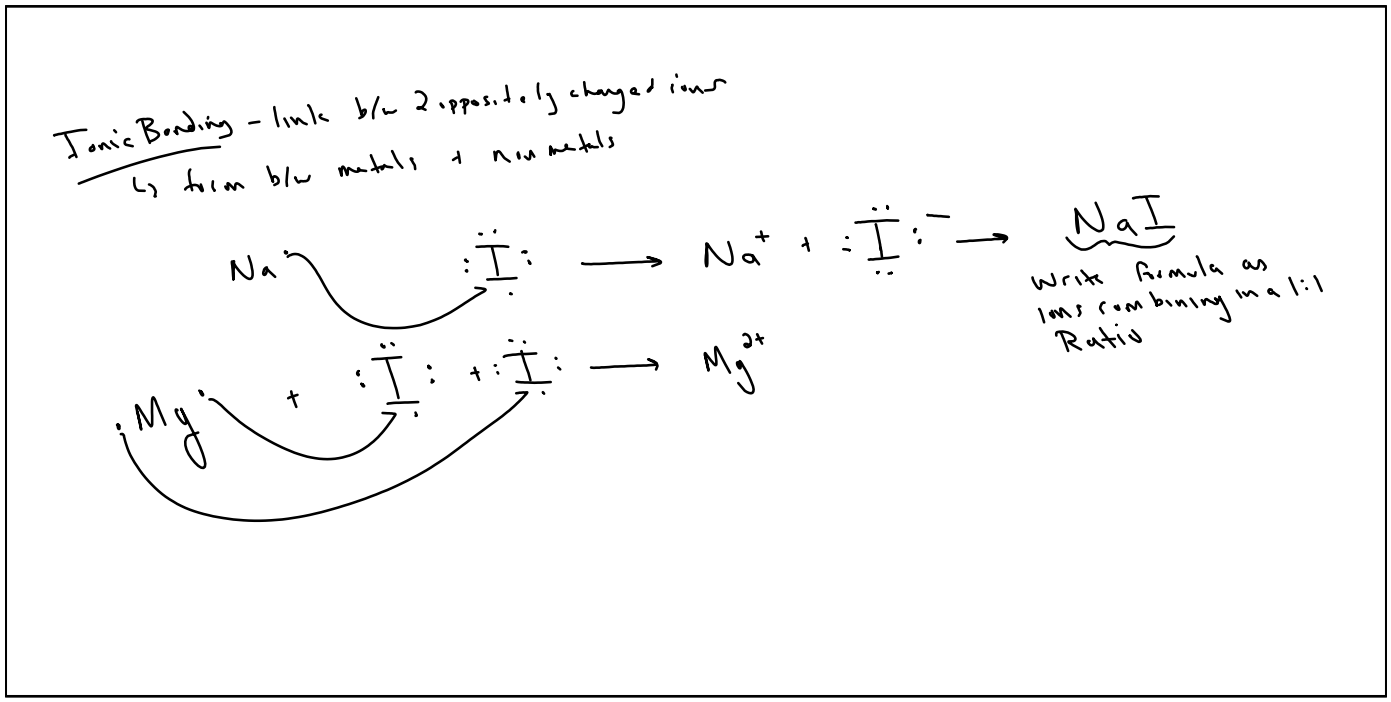
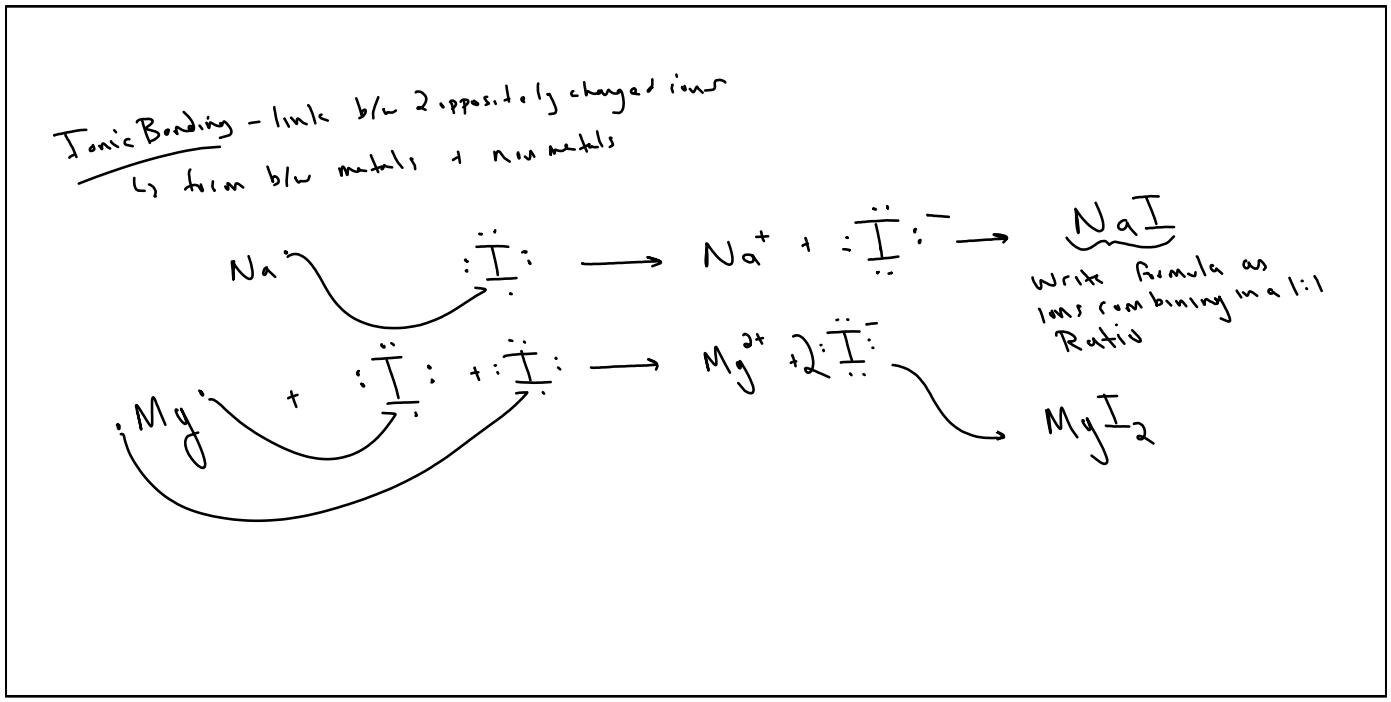

Ionic Bonding - link b/w 2 oppositely charged ions
by from b/w metals + non metals
Na
Na+ + I:-
NaI
Write formula as ions combining in a 1:1 Ratio
Mg
+


Ionic Bonding - link b/w 2 oppositely charged ions
↳ form b/w metals + non metals
Na
Na+ + I-
NaI
Write formula as ions combining in a 1:1 Ratio
Mg
Mg2+


Ionic Bonding - link b/w 2 oppositely charged ions
by form b/w metals + non metals
Na
Na+ + I-
NaI
Write formula as ions combining in a 1:1 Ratio
Mg
Mg2+ + 2I-
MgI2

X-tural of Ionic Cmpds

X-tura of Ionic Cmps

↳ Cation can bond to multiple anions & vice versa
B/c charge goes off in all directions

X-tura of Ionic Cmps

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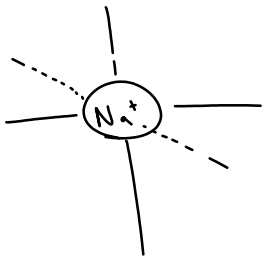
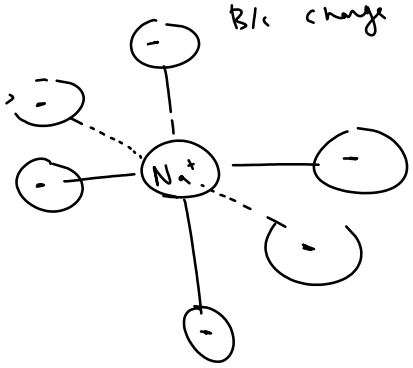


X-tura of Ionic Cmps

↳ Cation can bond to multiple anions & vice versa

B/c charge goes off in all directions

↳ Arrange themselves in crystal lattices

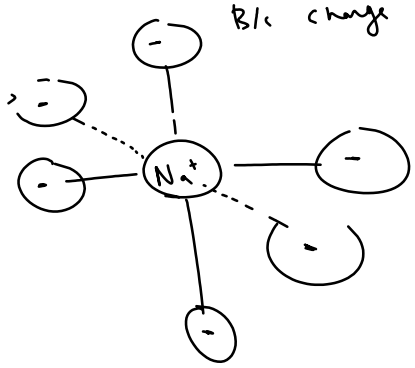


X-tura of Ionic Cmps

↳ Cation can bond to multiple anions & vice versa
B/c charge goes off in all directions

↳ Arrange themselves in crystal lattices

↳ highly organized Repeating patterns of ions

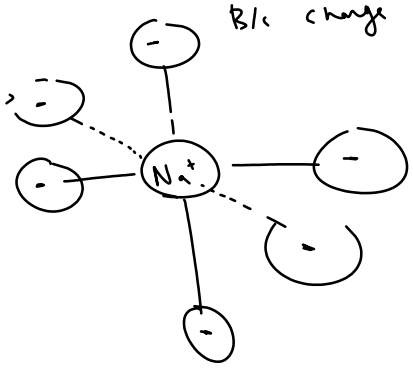


X-tura of Ionic Cmps

↳ Cation can bond to multiple anions ↕ vice versa

B/c charge goes off in all directions

↳ Arrange themselves in crystal lattices



↳ highly organized Repeating pattern of ions

↳ very hard to break ↑

B/c of # of Bonds B/w Ions

↑ high E needed to Break Bonds

Properties Compared to Ionic Lattice

↳ high Melting Points

Properties Comp. b/c of Lattice

↳ high Melting Points

	MP
NaCl	801°C
Sucrose (sugar)	186°C

→ very Brittle b/c they Break ↑ along the lines of the lattice.

USER

VSEPR

↳ 3D shapes of covalent molecules

VSEPR

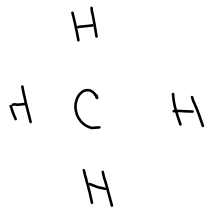
↳ 3D shapes of covalent molecules

CH_4

VSEPR

↳ 3D shapes of covalent molecules

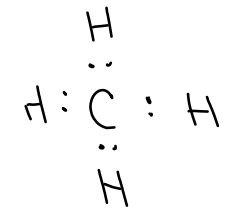
CH_4



VSEPR

↳ 3D shapes of covalent molecules

CH_4

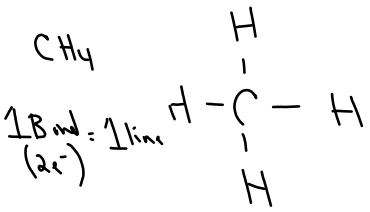


VSEPR

↳ 3D shapes of covalent molecules

CH_4

1 Bond (2e⁻) = 1 line

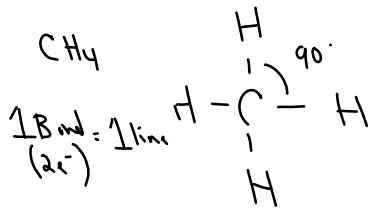


VSEPR

↳ 3D shapes of covalent molecules

CH_4

1 Bond (2e⁻) = 1 line



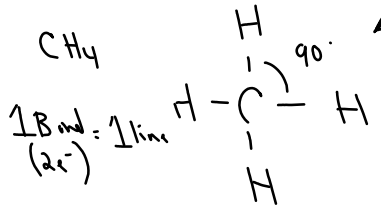
VSEPR

↳ 3D shapes of covalent molecules

In molecules, Bonds arrange themselves to be as far apart as possible

CH_4

1 Bond (2e⁻) = 1 line



VSEPR

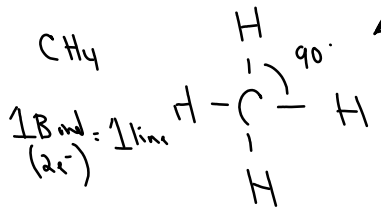
↳ 3D shapes of covalent molecules

In molecules, Bonds arrange themselves to be as far apart as possible

Bc e⁻ in bonds repel each other

CH_4

1 Bond (2e⁻) = 1 line

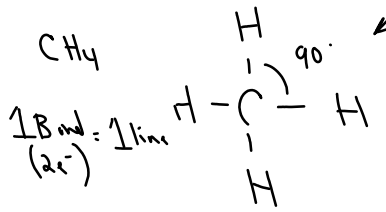


VSEPR

↳ 3D shapes of covalent molecules

CH_4

1 Bond (2 e⁻) = 1 line



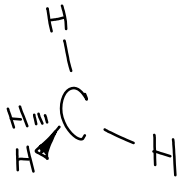
In molecules, Bonds arrange themselves to be as far apart as possible

Bc e⁻ in bonds Repel each other

In 3-D Bonds can arrange to have ∠'s bigger than 90°

VSEPR

↳ 3D shapes of covalent molecules



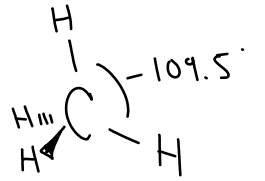
In molecules, Bonds arrange themselves to be as far apart as possible

Bc e⁻ in bonds Repel each other

In 3-D Bonds can arrange to have ∠'s bigger than 90°

VSEPR

↳ 3D shapes of covalent molecules



tetrahedral shape

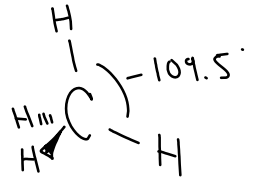
In molecules, Bonds arrange themselves to be as far apart as possible

Bc e⁻ in bonds Repel each other

In 3-D Bonds can arrange to have ∠'s bigger than 90°

VSEPR - valence shell e⁻ pair Repulsion

↳ 3D shapes of covalent molecules



tetrahedral shape

In molecules, Bonds arrange themselves to be as far apart as possible

Bc e⁻ in bonds Repel each other

In 3-D Bonds can arrange to have ∠'s bigger than 90°

VSEPR Table

Molecule Type	# of unshared e⁻ pairs on Central atom	Geometry Type	Bond ∠	Ex Molec	Structures

VSEPR Table

Molecule Type	# of unshared e⁻ pairs on Central atom	Geometry Type	Bond ∠	Ex Molec	Structures
A_2	—			H_2	H–H

VSEPR Table

Molecule Type	# of unshared e⁻ pairs on Central atom	Geometry Type	Bond ∠	Ex Molec	Structures
A_2	—	linear	180°	H_2	H–H

VSEPR Table

Molecule Type	# of unshared e⁻ pairs on Central atom	Geometry Type	Bond ∠	Ex Molec	Structures
A_2	—	linear	180°	H_2, HCl	H–H, H–Cl:

VSEPR Table

Molecule Type	# of unshared e⁻ pairs on Central atom	Geometry Type	Bond ∠	Ex Molec	Structures
A_2	—	linear	180°	H_2, HCl	H–H, H–Cl: (A₂ just means 2 atoms)

VSEPR Table

Molecule Type	# of unshared e⁻ pairs on Central atom	Geometry Type	Bond ∠	Ex Molec	Structures
A_2	—	linear	180°	H_2, HCl	H–H, H–Cl: (A₂ just means 2 atoms)
AB_2					

VSEPR Table

Molecule Type	# of unshared e⁻ pairs on Central atom	Geometry Type	Bond ∠	Ex Molec	Structures
A_2	—	linear	180°	H_2, HCl	H-H, H-Cl: (A₂ just means 2 atoms)
AB_2 (A = Central atom)					

VSEPR Table

Molecule Type	# of unshared e⁻ pairs on Central atom	Geometry Type	Bond ∠	Ex Molec	Structures
A_2	—	linear	180°	H_2, HCl	H–H, H–Cl: (A₂ just means 2 atoms)

AB_2

(Central atom; in 2 Branches)

VSEPR Table

Molecule Type	# of unshared e⁻ pairs on Central atom	Geometry Type	Bond ∠	Ex Molec	Structures
A_2	—	linear	180°	H_2, HCl	H–H, H–Cl: (A₂ just mean, 2 atoms)
AB_2				CO_2	

VSEPR Table

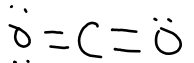
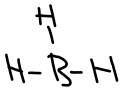
Molecule Type	# of unshared e⁻ pairs on Central atom	Geometry Type	Bond ∠	Ex Molec	Structures
					A_2 just means 2 atoms
A_2	—	linear	180°	H_2, HCl	H–H, H–Cl:
AB_2				CO_2	O=C=O

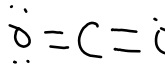
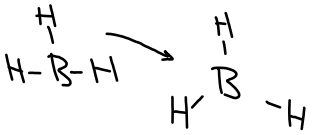
VSEPR Table

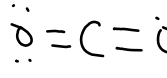
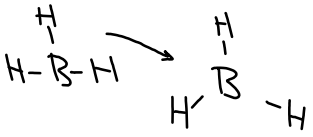
Molecule Type	# of unshared e⁻ pairs on Central atom	Geometry Type	Bond ∠	Ex Molec	Structures
A_2	—	linear	180°	H_2, HCl	H-H, H-Cl: (A₂ just means 2 atoms)
AB_2	0	linear	180°	CO_2	O=C=O

VSEPR Table Molecule Type	# of unshared e⁻ pairs on central atom	Geometry Type	Bond ∠	Ex	Structure
A_2	—	linear	180°	H_2	H–H
AB_2	0	linear	180°	CO_2	:Ö=C=Ö:

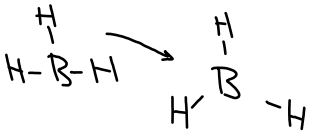
VSEPR Table Molecule Type	# of unshared e⁻ pairs on central atom	Geometry Type	Bond ∠	Ex	Structure
					H–H
A_2	—	linear	180°	H_2	
AB_2	0	linear	180°	CO_2	:Ö=C=Ö:
AB_3					

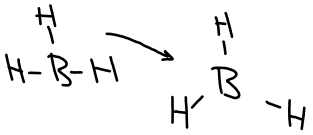
BePR Table Molecule Type	# of unshared e⁻ pairs on central atom	Geometry Type	Bond ∠	Ex	Structure
A_2	—	linear	180°	H_2	H–H
AB_2	0	linear	180°	CO_2	
AB_3				BH_3	

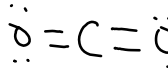
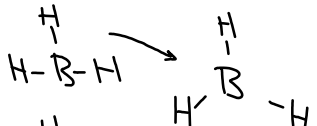
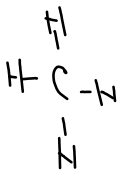
VSEPR Table Molecule Type	# of unshared e⁻ pairs on central atom	Geometry Type	Bond ∠	Ex	Structure
A_2	—	linear	180°	H_2	H–H
AB_2	0	linear	180°	CO_2	
AB_3				BH_3	

VSEPR Table Molecule Type	# of unshared e⁻ pairs on central atom	Geometry Type	Bond ∠	Ex	Structure
A_2	—	linear	180°	H_2	H–H
AB_2	0	linear	180°	CO_2	
AB_3			120°	BH_3	

VSEPR Table Molecule Type	# of unshared e⁻ pairs on central atom	Geometry Type	Bond ∠	Ex	Structure
A_2	—	linear	180°	H_2	H–H
AB_2	0	linear	180°	CO_2	:Ö=C=Ö:
AB_3		trigonal planar	120°	BH_3	H–B(H)–H

VSEPR Table Molecule Type	# of unshared e⁻ pairs on central atom	Geometry Type	Bond ∠	Ex	Structure
A_2	—	linear	180°	H_2	H–H
AB_2	O	linear	180°	CO_2	:Ö=C=Ö:
AB_3	O	trigonal planar	120°	BH_3	

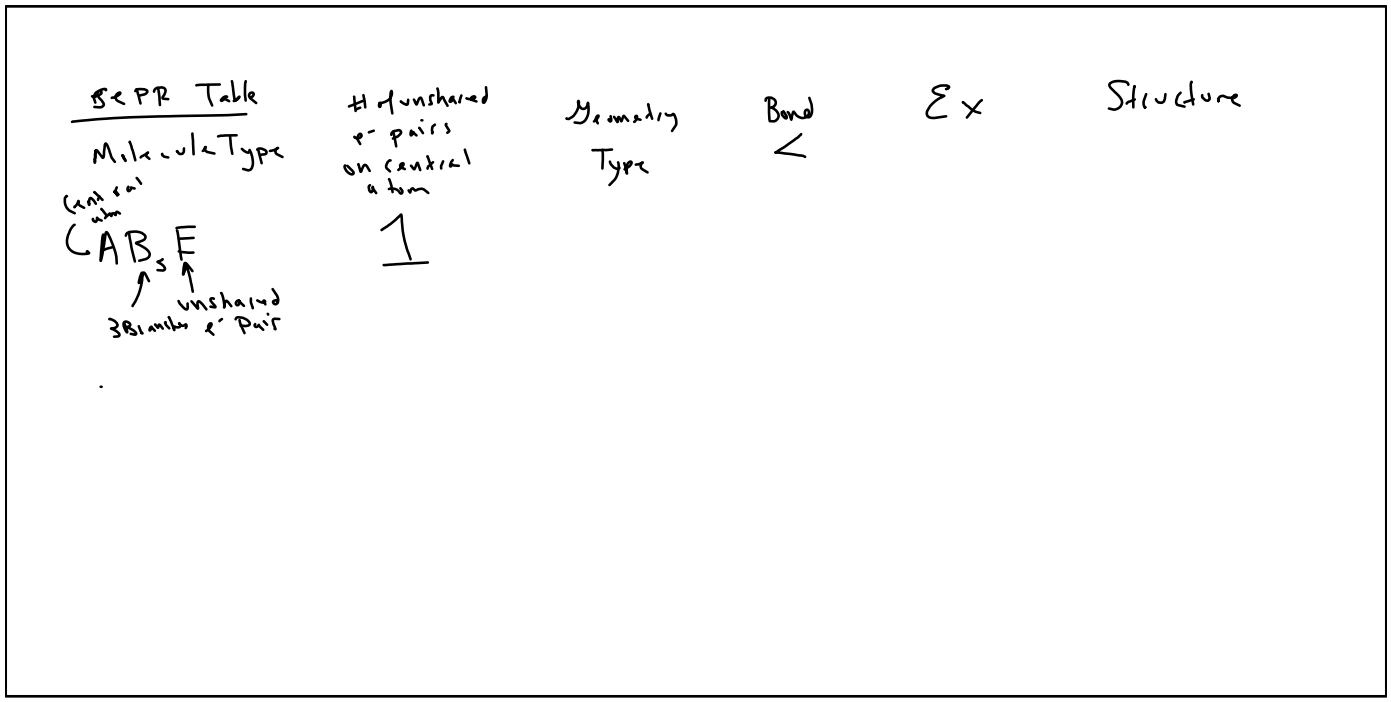
VSEPR Table Molecule Type	# of unshared e⁻ pairs on central atom	Geometry Type	Bond ∠	Ex	Structure
A_2	—	linear	180°	H_2	H–H
AB_2	O	linear	180°	CO_2	:Ö=C=Ö:
AB_3	O	trigonal planar	120°	BH_3	
AB_4					

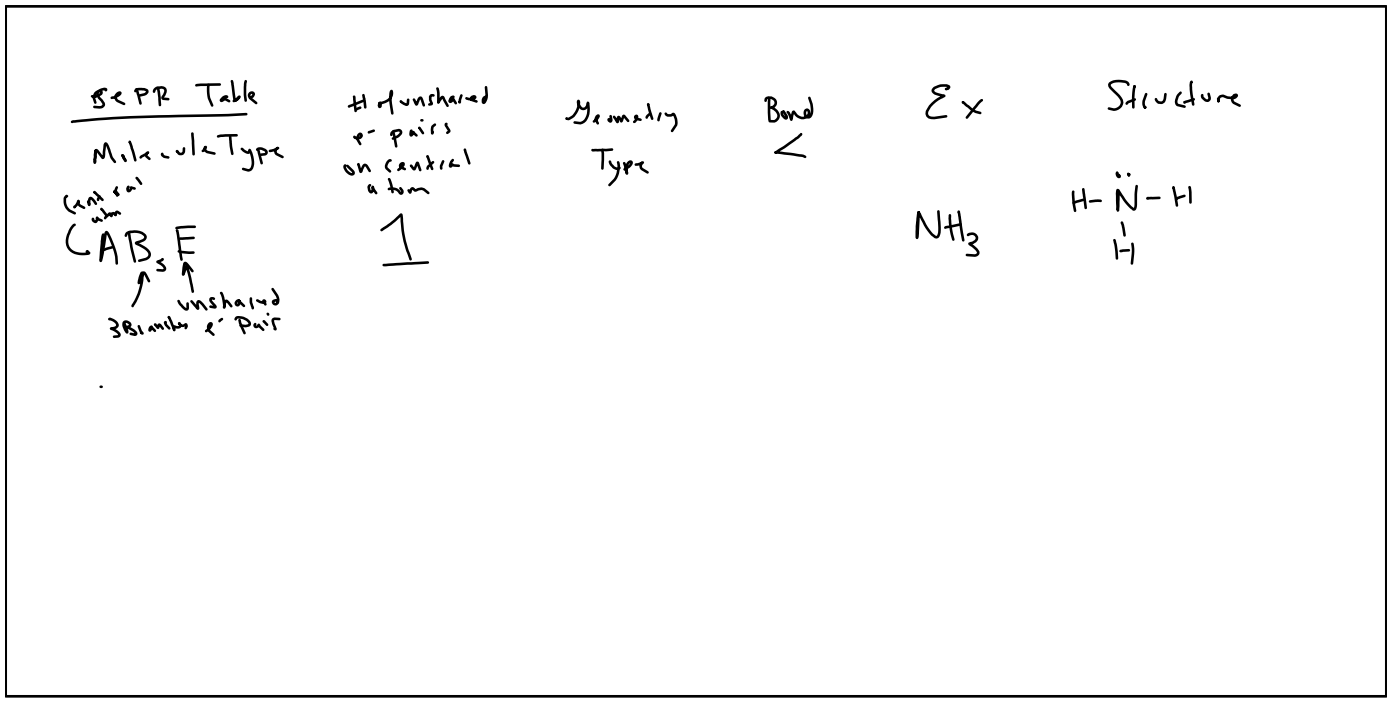
Molecule Type	# of unshared e⁻ pairs on central atom	Geometry Type	Bond ∠	Ex	Structure
A_2	—	linear	180°	H_2	H–H
AB_2	0	linear	180°	CO_2	
AB_3	0	trigonal planar	120°	BH_3	
AB_4	0	tetrahedral		CH_4	

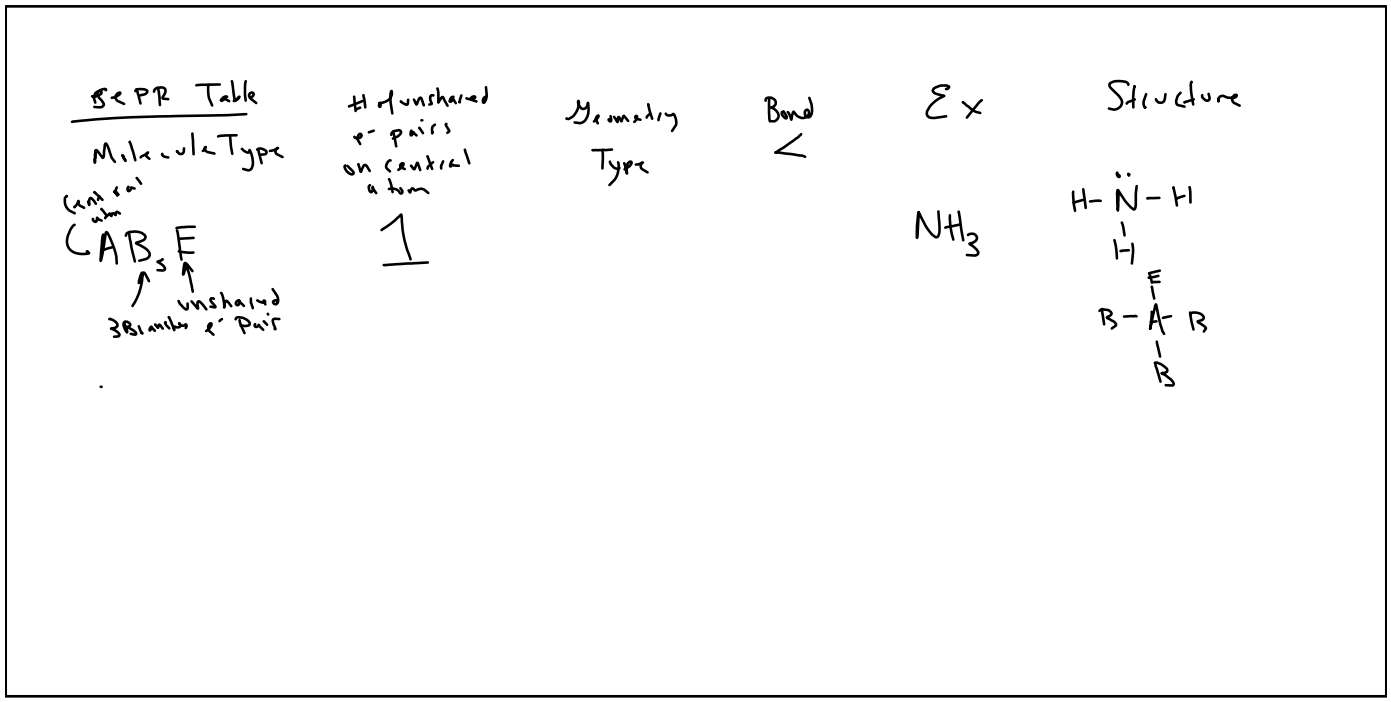
VSEPR Table Molecule Type	# of unshared e⁻ pairs on central atom	Geometry Type	Bond ∠	Ex	Structure
A_2	—	linear	180°	H_2	H–H
AB_2	0	linear	180°	CO_2	:Ö=C=Ö:
AB_3	0	trigonal planar	120°	BH_3	H–B(–H)–H →
AB_4	0	tetrahedral	109.5°	CH_4	H–C(–H)–H →

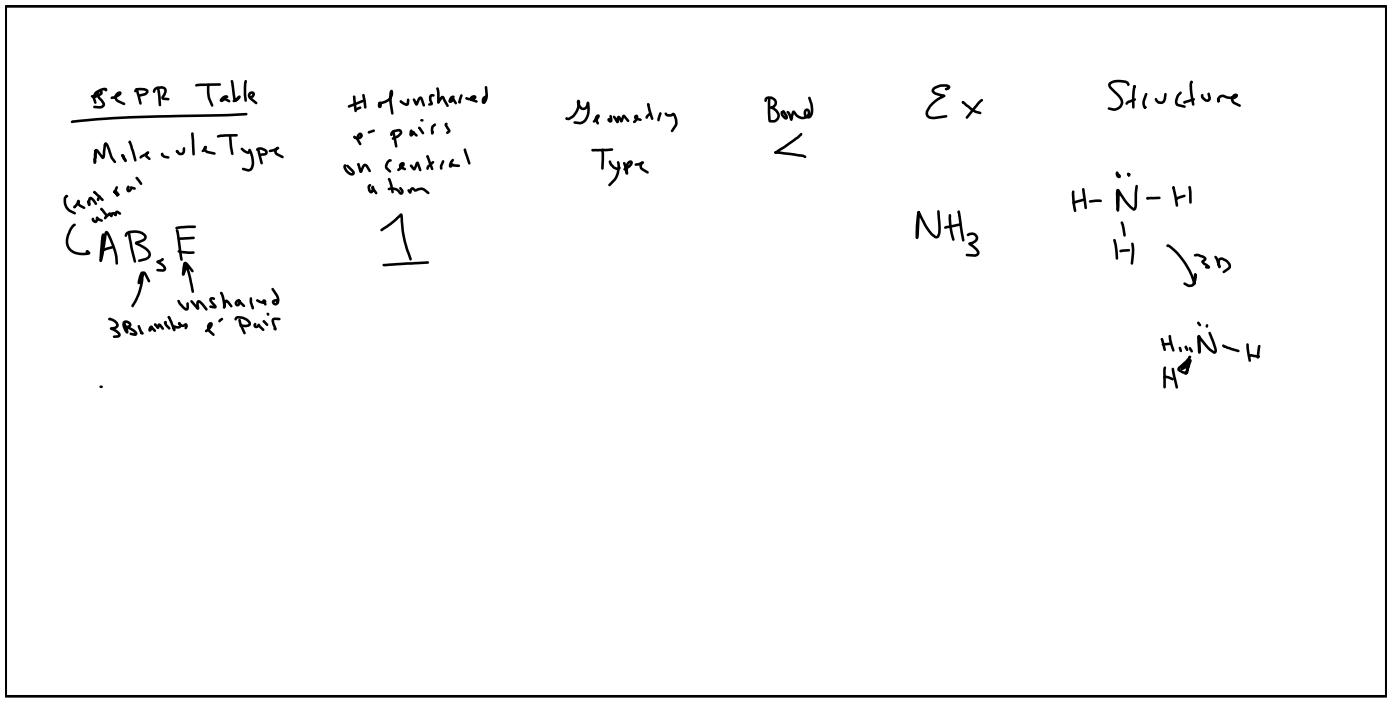
VSEPR Table Molecule Type	# of unshared e⁻ pairs on central atom	Geometry Type	Bond ∠	Ex	Structure

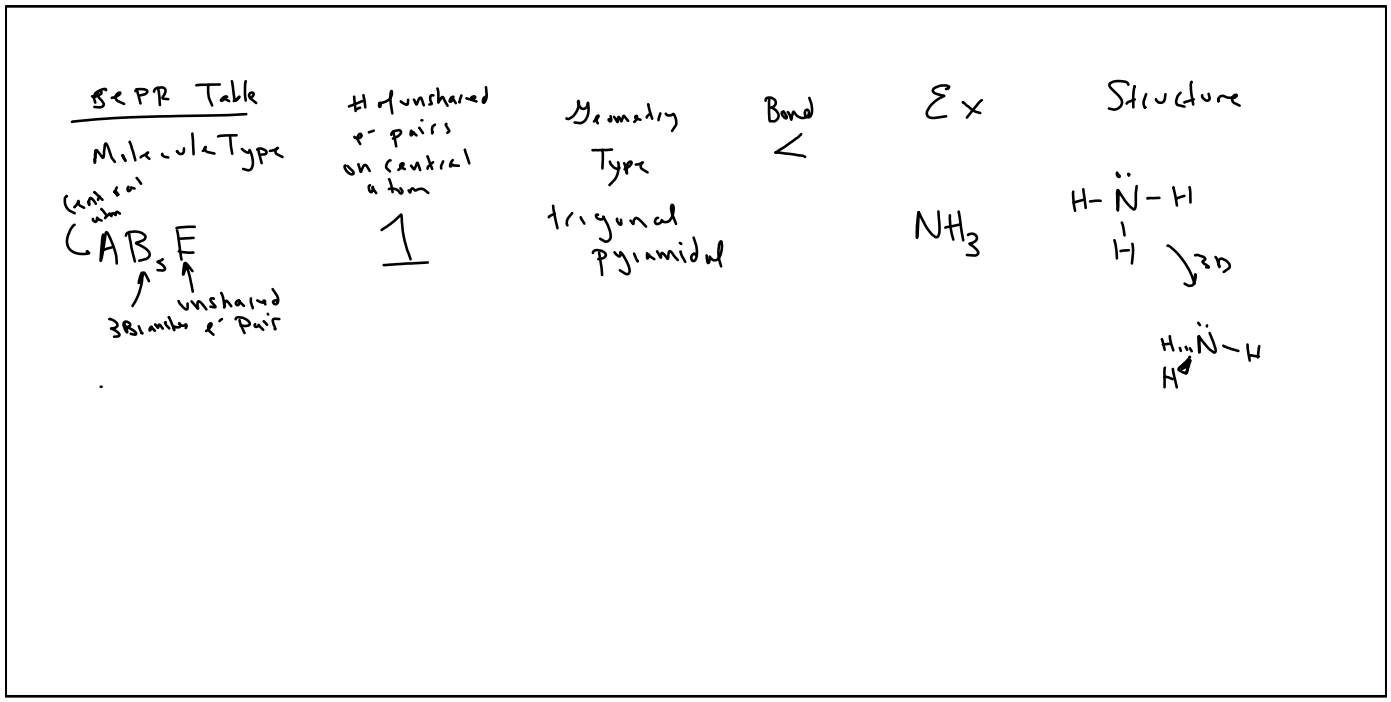
VSEPR Table Molecule Type	# of unshared e⁻ pairs on central atom	Geometry Type	Bond ∠	Ex	Structure
AB_5F					

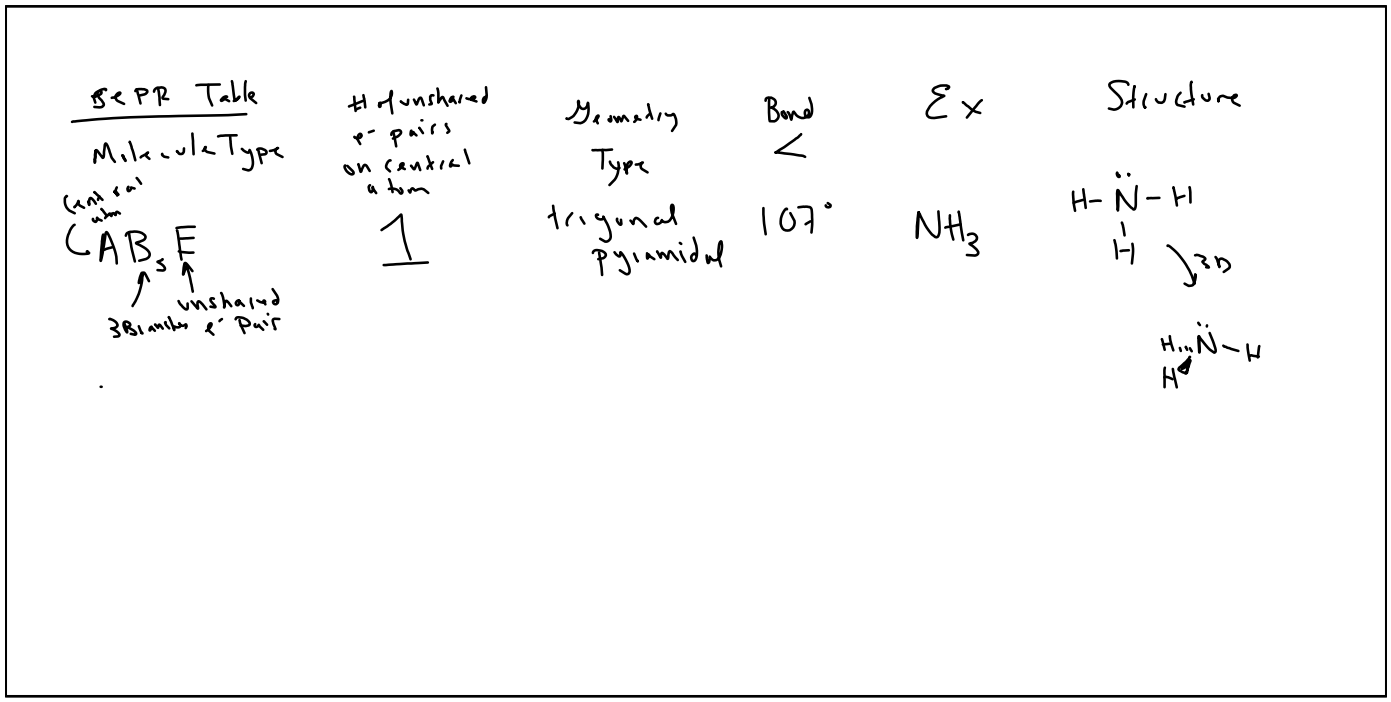

BePR Table
Molecule Type
Central atom
CAB3E
3 Bonding e⁻ Pair
unshared e⁻ Pair
# of unshared e⁻ pairs on central atom
1
Geometry Type
Bond ∠
Ex
Structure


BePR Table
Molecule Type
Central atom
CAB5E
3 Bonding e⁻ Pair
unshared e⁻ Pair
# of unshared e⁻ pairs on central atom
1
Geometry Type
Bond ∠
Ex
NH3
Structure
H- N - H
H

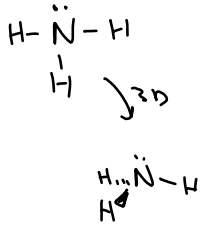

BcPR Table
Molecule Type
Central atom
CAB3E
3 Bonding e⁻ Pair
unshared e⁻ Pair
# of unshared e⁻ pairs on central atom
1
Geometry Type
Bond ∠
Ex
NH3
Structure
H- N - H
B - A - B
E
B

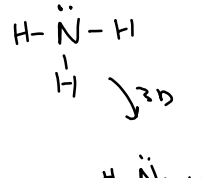
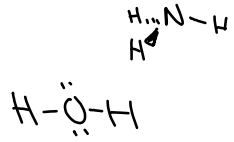

BePR Table
Molecule Type
Central atom
CAB3E
3 Bonding e⁻ Pair
unshared e⁻ Pair
# of unshared e⁻ pairs on central atom
1
Geometry Type
Bond ∠
Ex
NH3
Structure
H- N - H
H
3D
H
N - H
H

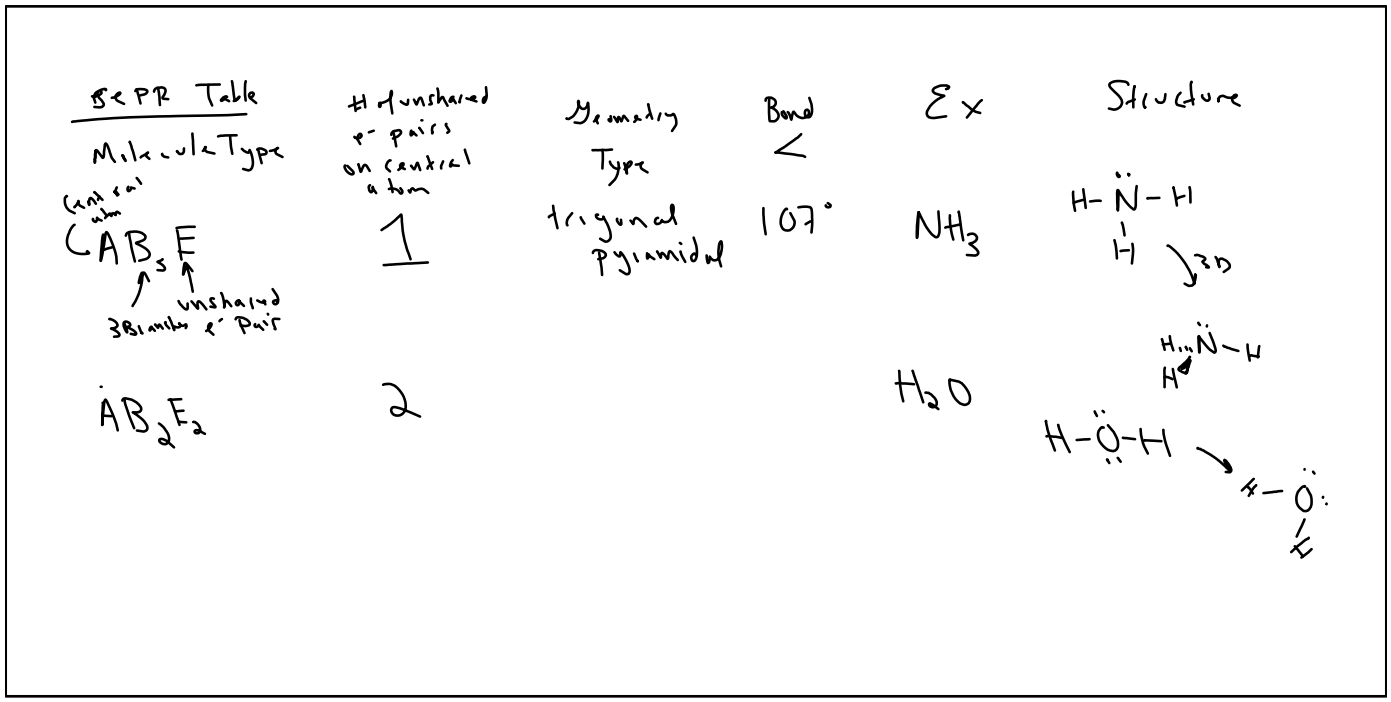

BePR Table
Molecule Type
Central atom
CAB3E
3 Bonding e⁻ Pair
unshared e⁻ Pair
# of unshared e⁻ pairs on central atom
1
Geometry Type
trigonal pyramidal
Bond ∠
Ex
NH3
Structure
3D

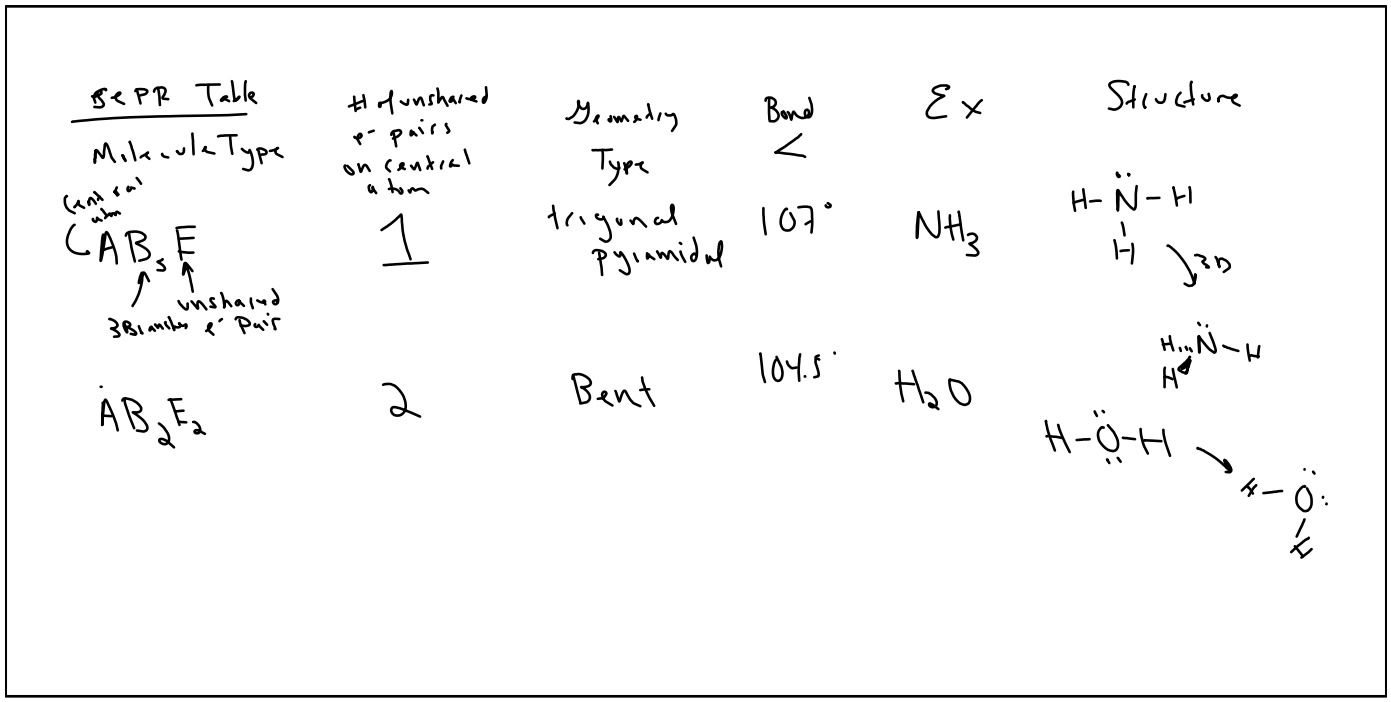

BePR Table
Molecule Type
Central atom
CAB3E
3 Bonding e⁻ Pair
unshared e⁻ Pair
# of unshared e⁻ pairs on central atom
1
Geometry Type
trigonal pyramidal
Bond ∠
107°
Ex
NH3
Structure
3D

BePR Table

Molecule Type (central atom)	# of unshared e⁻ pairs on central atom	Geometry Type	Bond ∠	Ex	Structure
AB_3E (3 B's around A; E = unshared e⁻ pair)	1	trigonal pyramid	107°	NH_3	
AB_2E_2					

VSEPR Table Molecule Type	# of unshared e⁻ pairs on central atom	Geometry Type	Bond ∠	Ex	Structure
AB_3E (A = central atom; B = 3 bonding e⁻ pairs; E = unshared e⁻ pair)	1	trigonal pyramidal	107°	NH_3	
AB_2E_2	2			H_2O	


BePR Table
Molecule Type
# of unshared e⁻ pairs on central atom
Geometry Type
Bond ∠
Ex
Structure
central atom
AB_3E
3 Bonding e⁻ Pair
unshared e⁻ Pair
1
trigonal pyramidal
107°
NH_3
3D
AB_2E_2
2
H_2O


BePR Table
Molecule Type
# of unshared e⁻ pairs on central atom
Geometry Type
Bond ∠
Ex
Structure
central atom
AB_3E
3 Bonding e⁻ Pair
unshared e⁻ Pair
1
trigonal pyramidal
107°
NH_3
3D
AB_2E_2
2
Bent
104.5°
H_2O

CH_2O

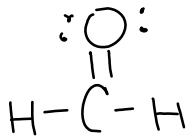
Draw Structure.

Give Molar Type

Give Geometry

CH_2O

Draw Structure.
Give Molecule Type
Give Geometry

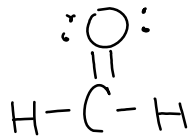


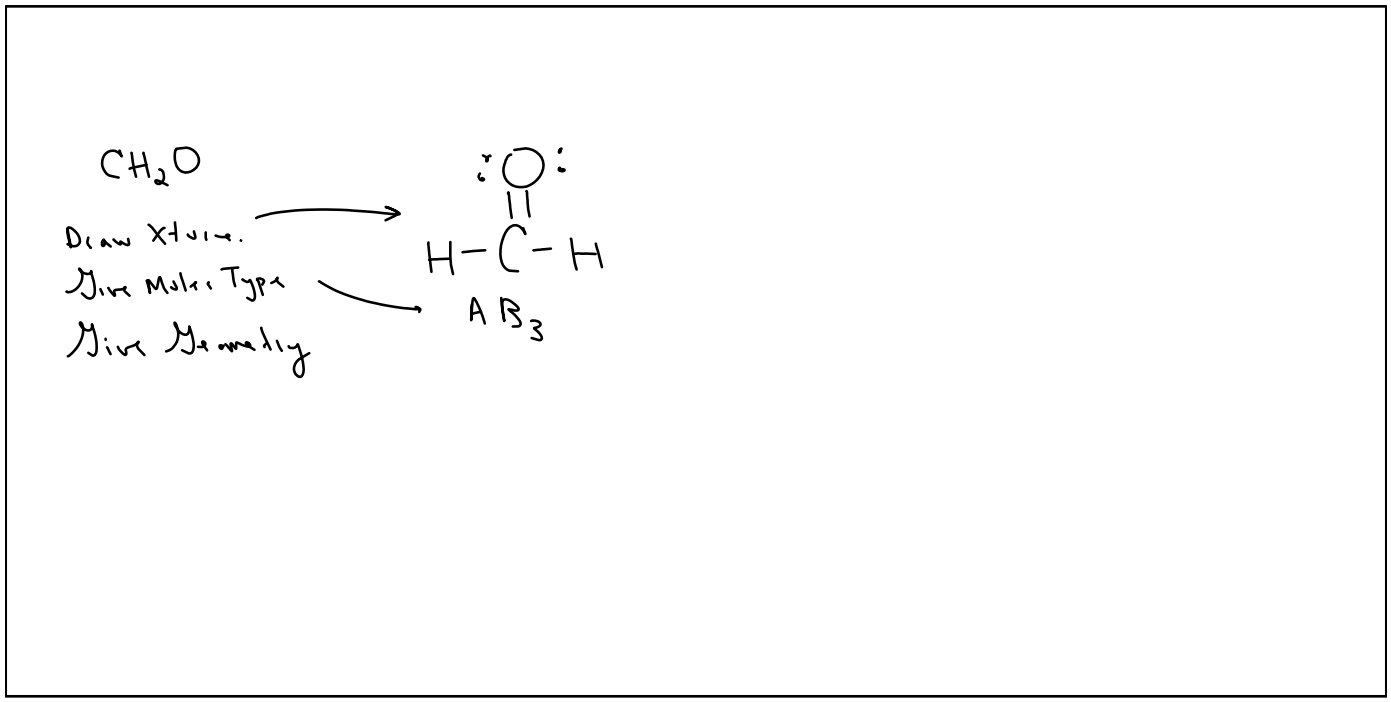
CH_2O

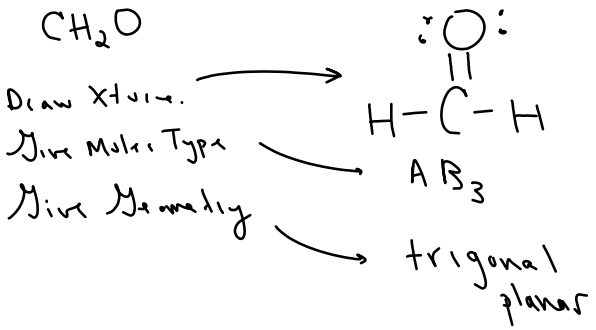
Draw Structure

Give Molar Type

Give Geometry




CH_2O
Draw Structure
Give Molec. Type
Give Geometry
H–C–H
AB_3


CH_2O
Draw Structure
Give Molec. Type
Give Geometry
H–C–H
AB_3
trigonal planar

Molecular Polarity

Molecular Polarity

↳ Is dependant on Bond Polarity & Geometry

Molecular Polarity

↳ Is dependant on Bond Polarity & Geometry

Bond Polarity - Polar Cov.

Nonpolar cov.

Molecular Polarity

↳ Is dependant on Bond Polarity & Geometry

Bond Polarity - Polar Cov. – forms b/c of e- neg differences; unequal sharing

Nonpolar cov.

Molecular Polarity

↳ Is dependant on Bond Polarity & Geometry

Bond Polarity - Polar Cov. – forms b/c of e- neg difference; unequal e- sharing

Nonpolar cov. - equal e- sharing (No diff in enrg)

Molecular Polarity

↳ Is dependant on Bond Polarity & Geometry

Bond Polarity - Polar Cov. – forms b/c of e- neg difference; so unequal e- sharing
↳ 2-Different elements

Nonpolar cov. - equal e- sharing (No diff in eneg)

Molecular Polarity

↳ Is dependant on Bond Polarity & Geometry

Bond Polarity - Polar Cov. – forms b/c of e- neg difference; sources equal e- sharing

↳ 2-Different Elements ($C^{\delta+} \rightarrow O^{\delta-}$)

Nonpolar cov. - equal e- sharing (No diff in enrg)

Molecular Polarity

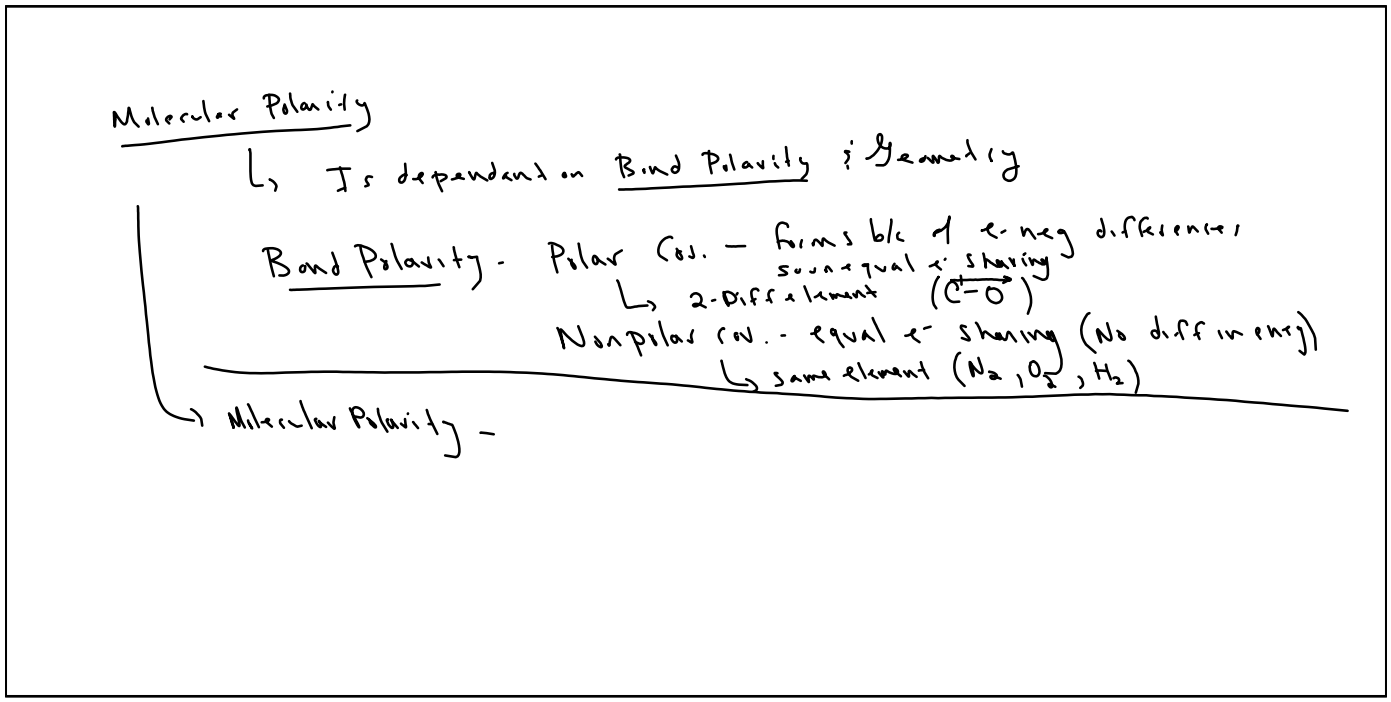
↳ Is dependant on Bond Polarity & Geometry

Bond Polarity - Polar Cov. – forms b/c of e- neg difference; sources equal e- sharing

↳ 2-Diff elements ($C^{+}\!\rightarrow\!O^{-}$)

Nonpolar cov. - equal e- sharing (No diff in eng)

↳ same element (N_2, O_2, H_2)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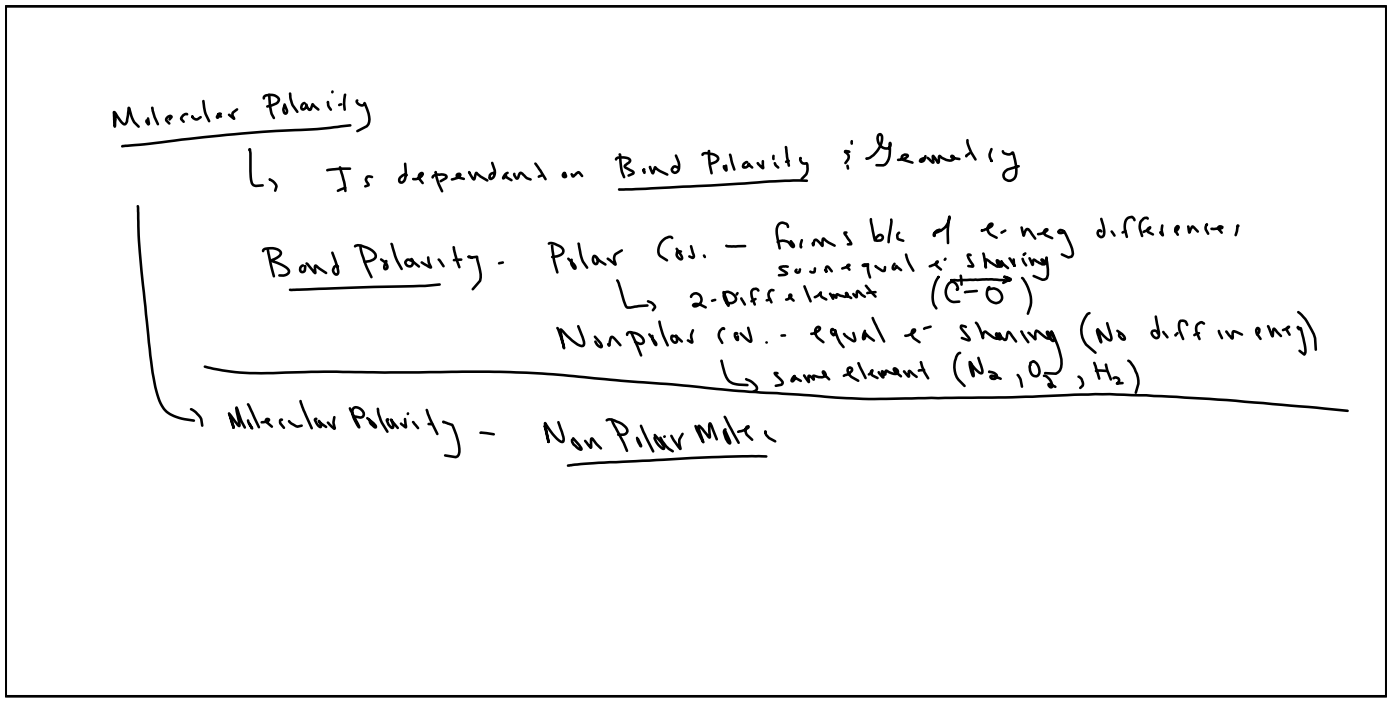
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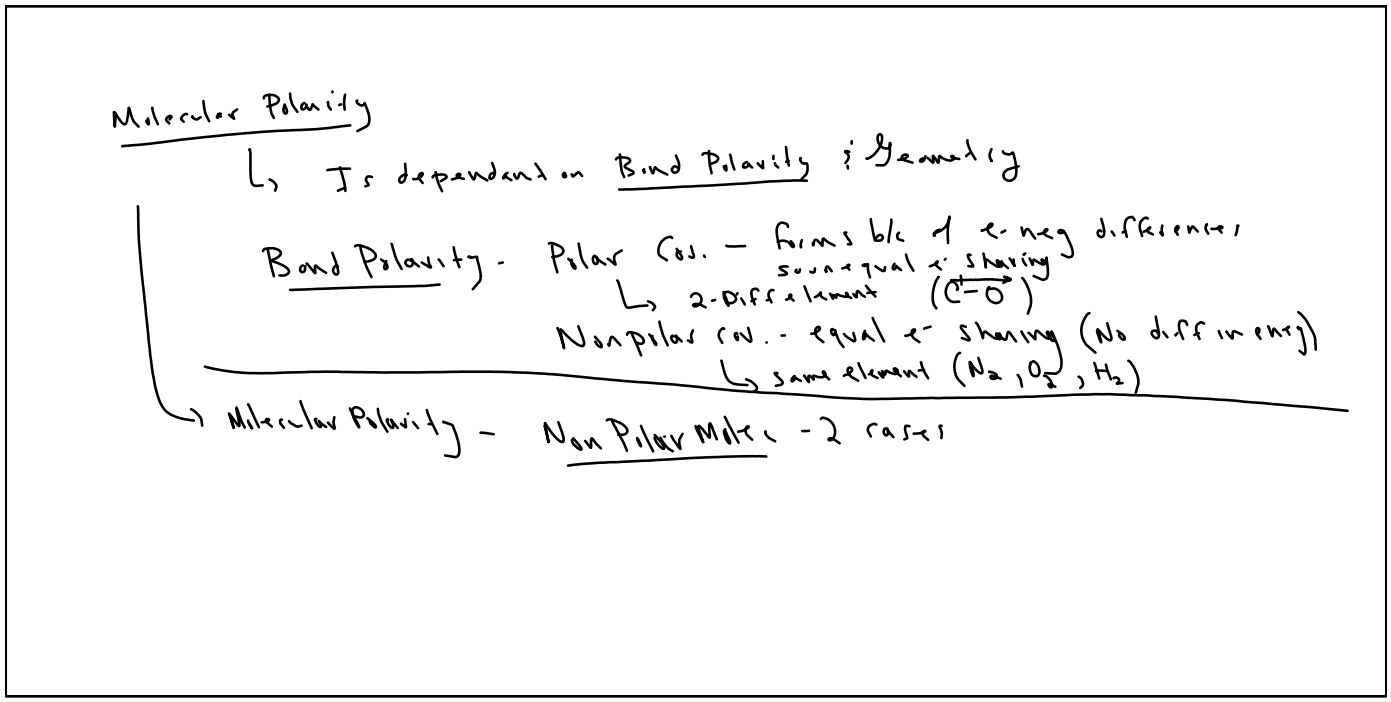
↳ Molecular Polarity - Non Polar Mole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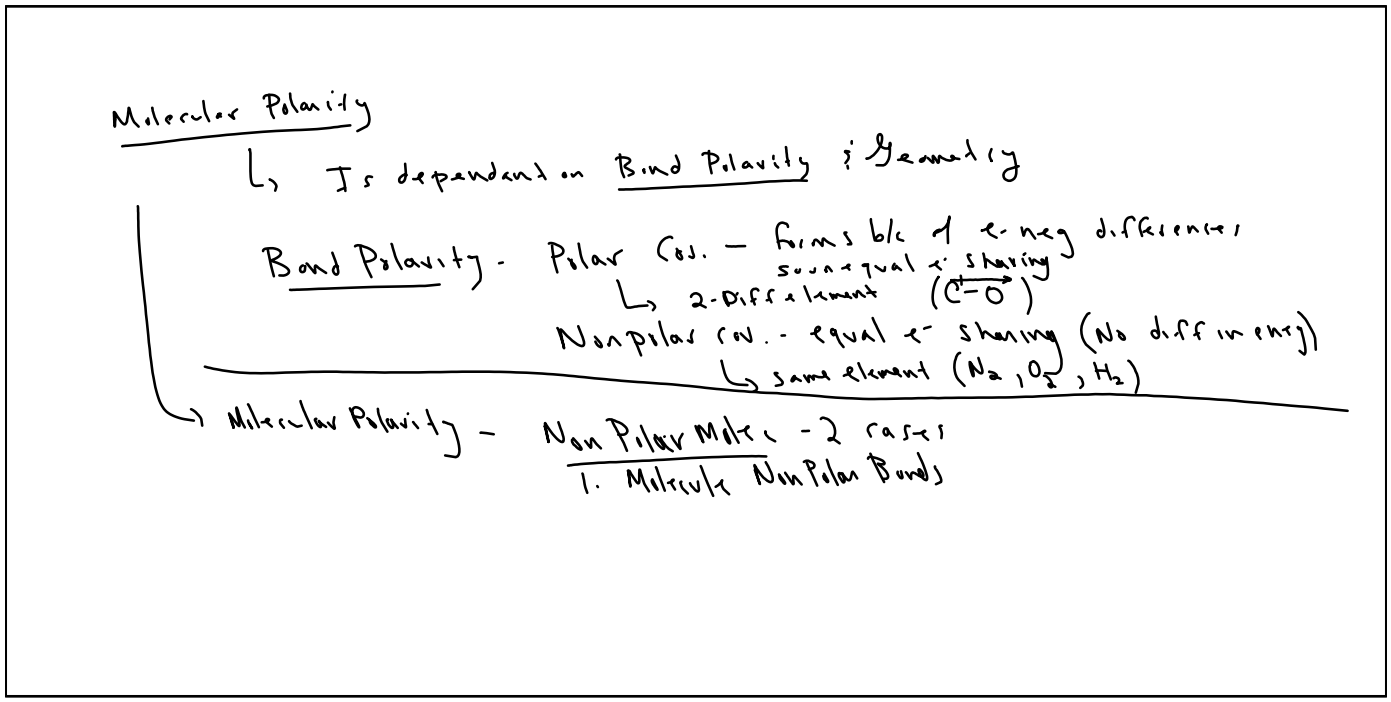
↳ Molecular Polarity – Non Polar Molec - 2 cases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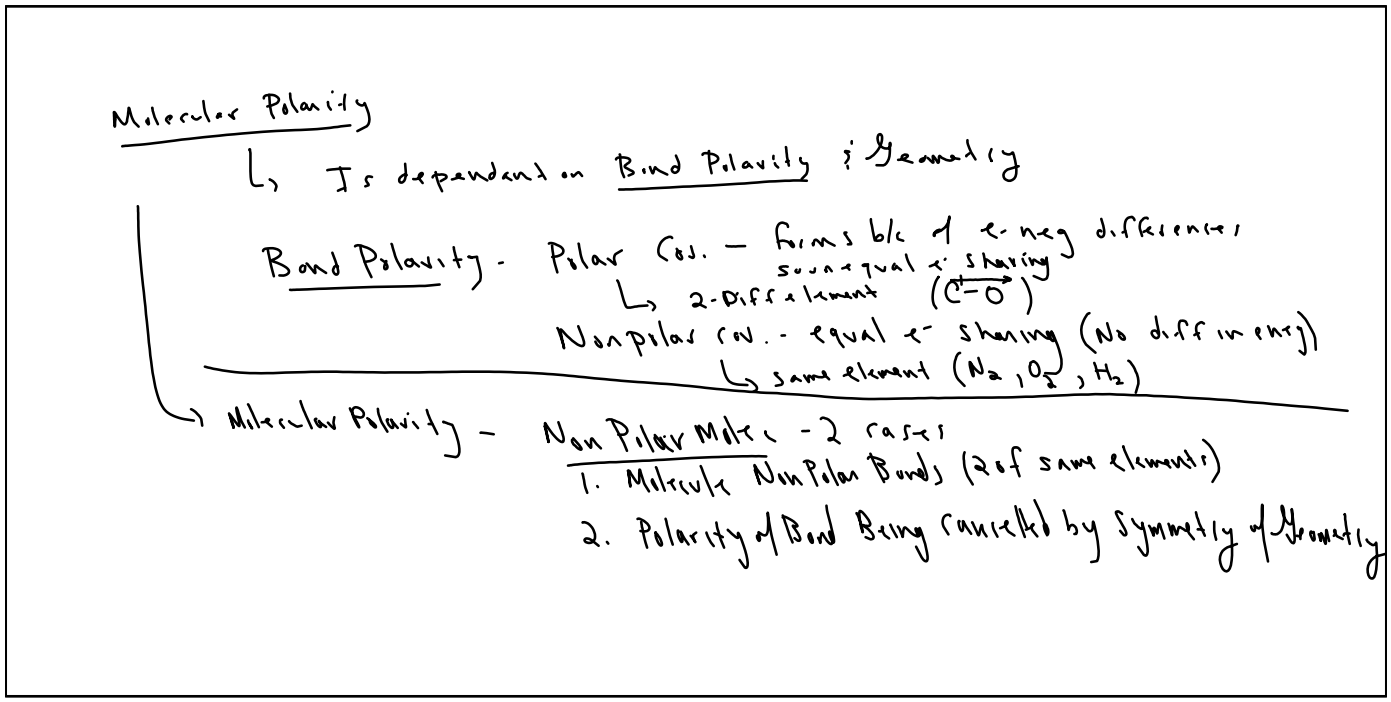
1. Molecule NonPolar Bonds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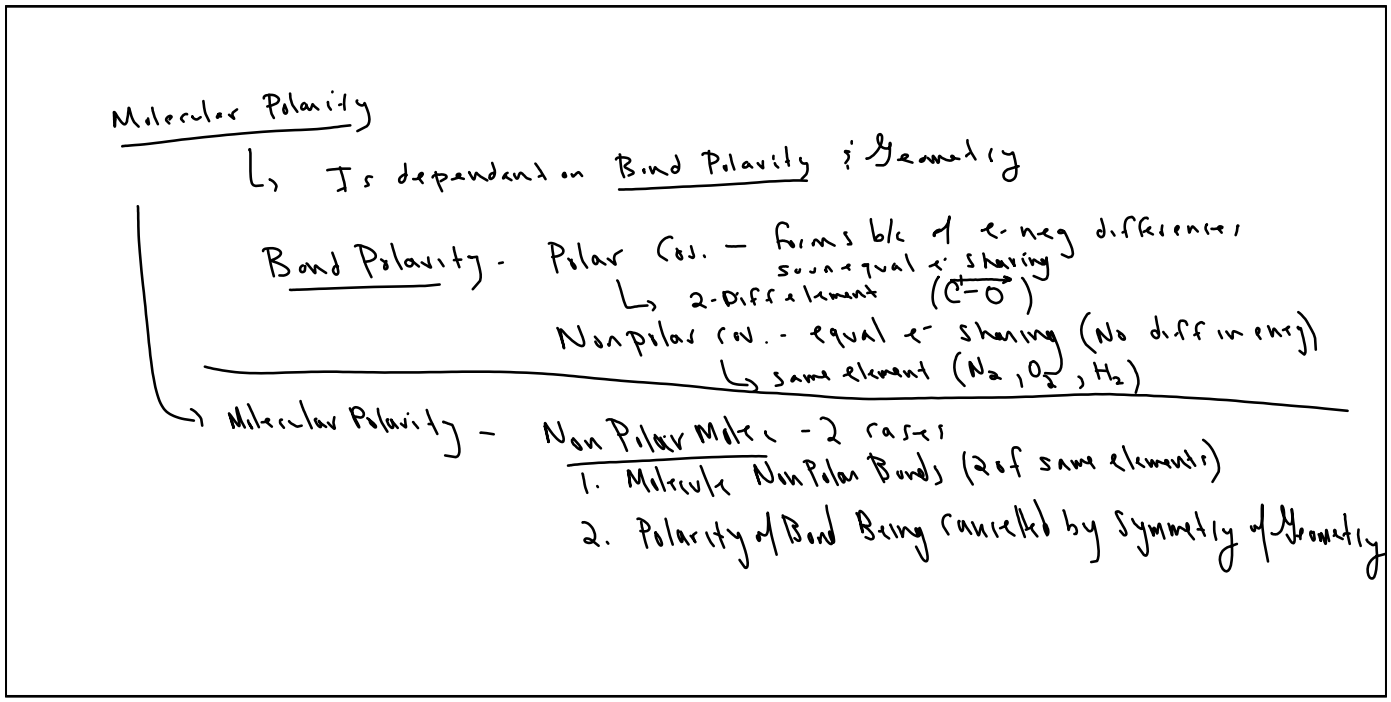
1. Molecule NonPolar Bonds (2 of same elements)
2. Polarity of Bond Being cancelled by Symmetry of Geometry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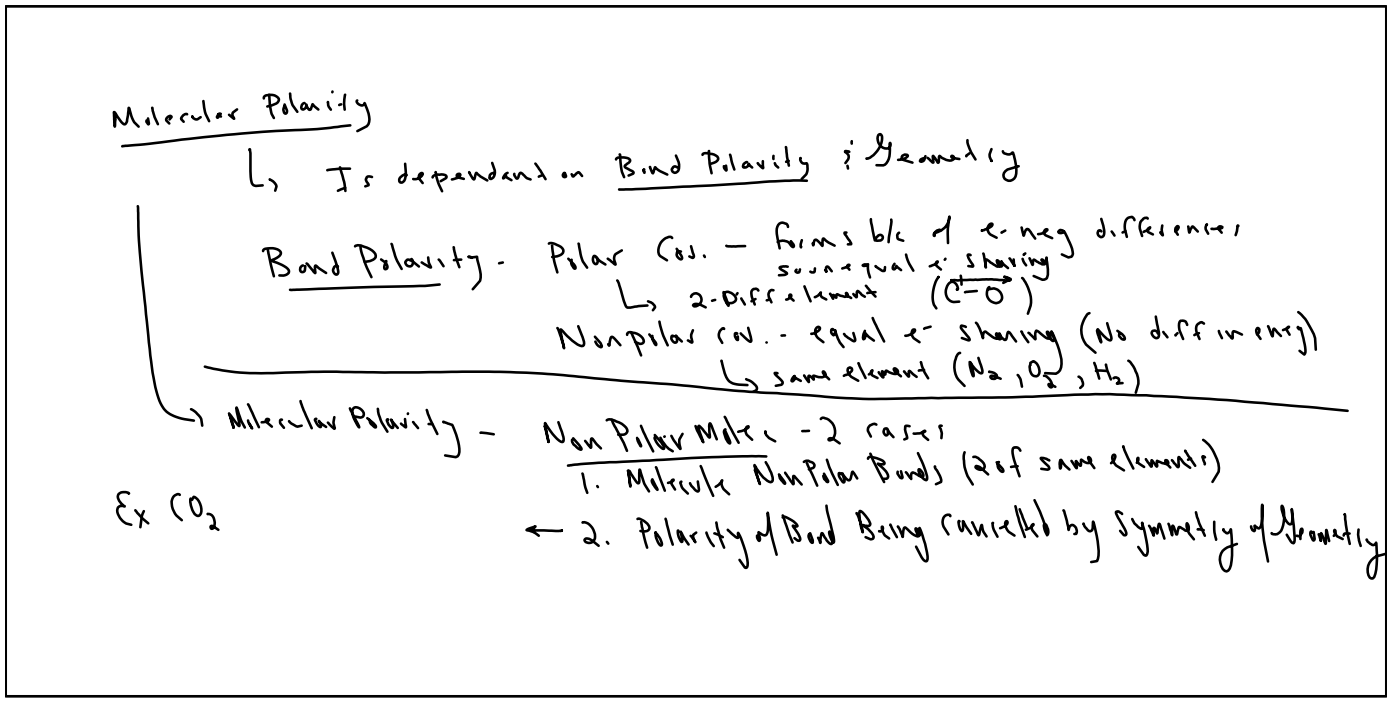
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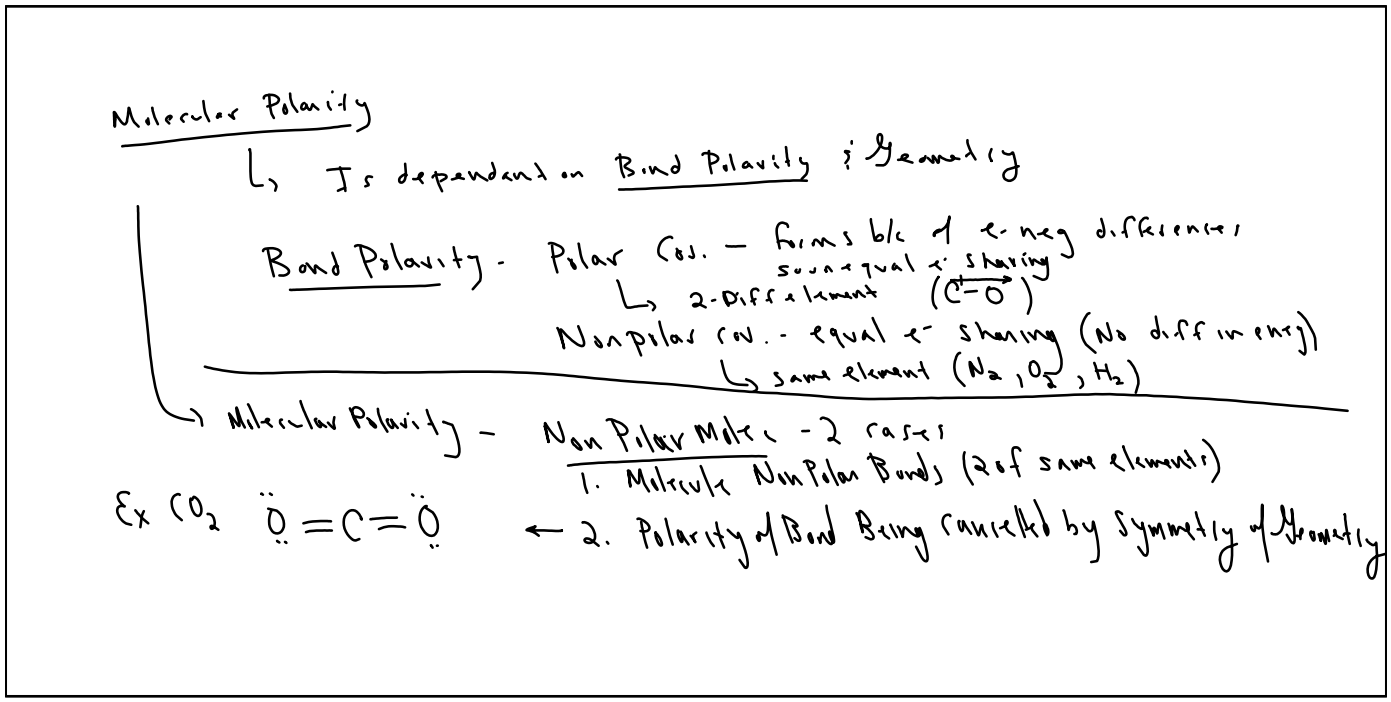
Ex CO2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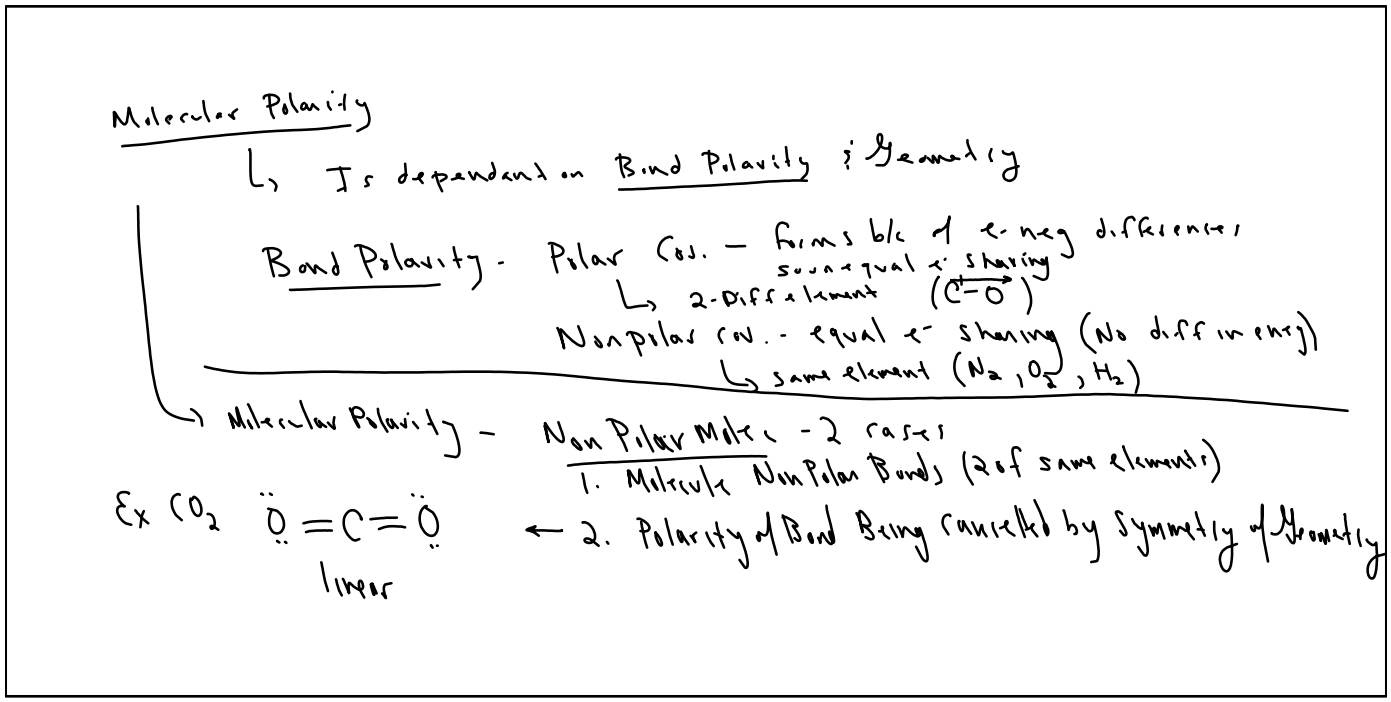
Ex CO2 Ö::C::Ö ← 2. Polarity of Bond Being canceled by Symmetry of Geometry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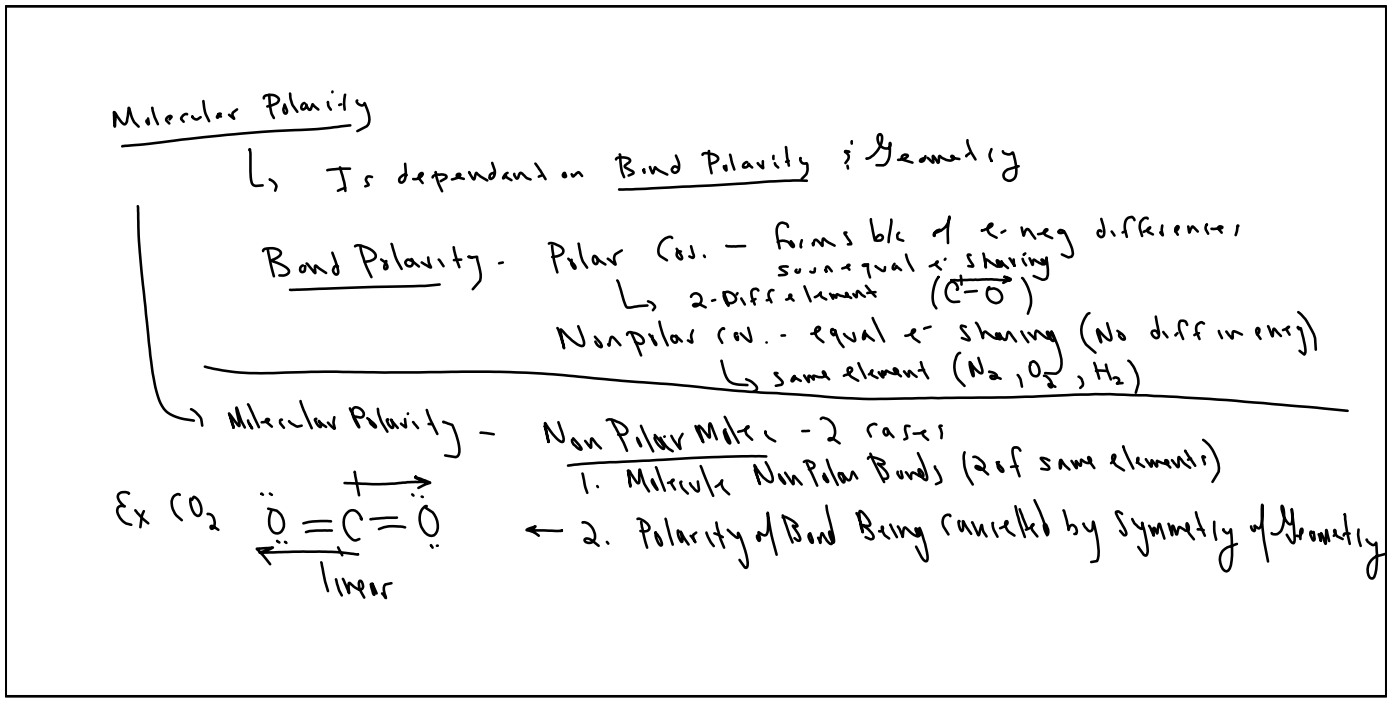
1. Molecule Nonpolar Bonds (2 of same elements)
Ex CO2 Ö=C=Ö ← 2. Polarity of Bond Being canceled by Symmetry of Geometry
linear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↳ Is dependant on Bond Polarity & Geometry
Bond Polarity - Polar Cov. – forms b/c of e- neg difference; sometimes equal e- sharing
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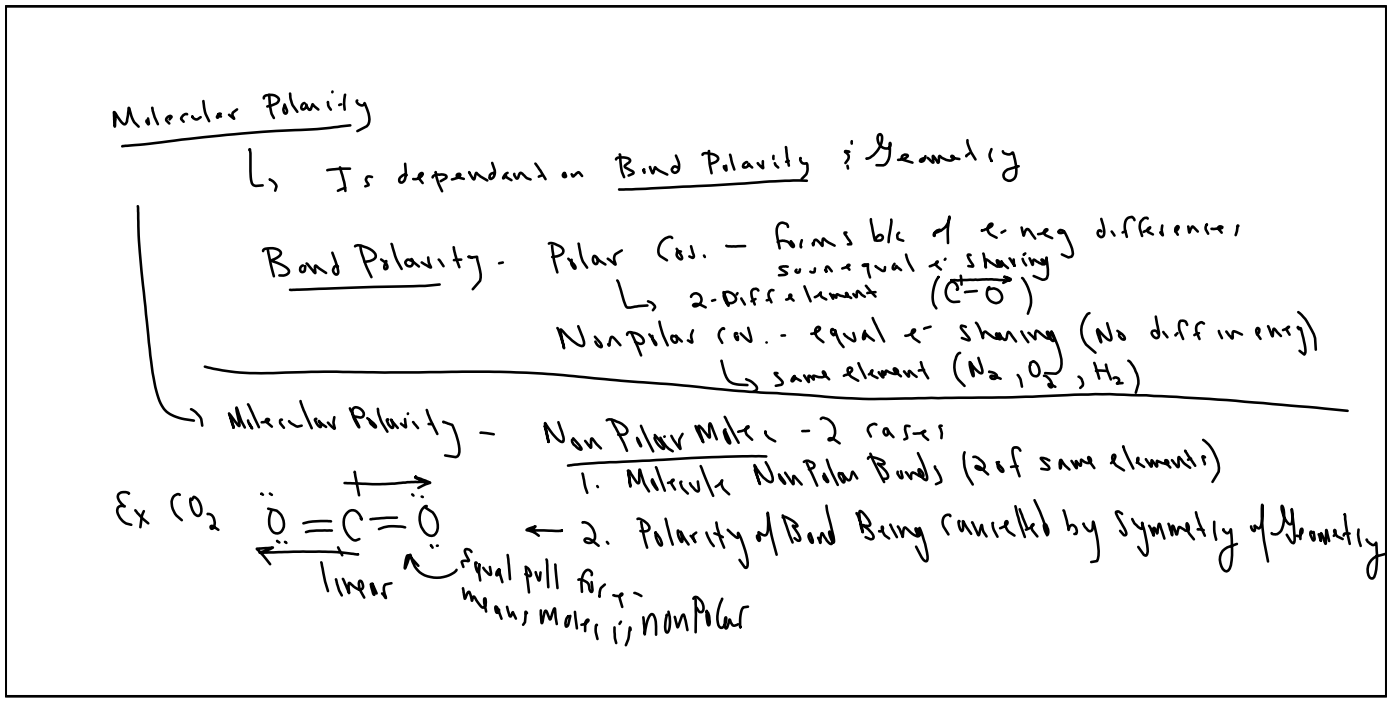
1. Molecule Nonpolar Bonds (2 of same elements)
Ex CO2 O=C=O
linear
← 2. Polarity of Bond Being cancelled by Symmetry of Geometry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1. Molecule NonPolar Bonds (2 of same elements)
Ex CO2 O=C=O ← 2. Polarity of Bond Being cancelled by Symmetry of Geometry
linear
equal pull for, means molec is nonPolar

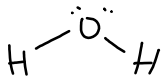
Polar Molecule

Polar Molecule → Polar Bonds & NO symmetry

Ex H_2O

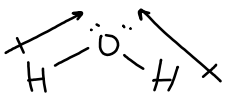
Polar Molecule → Polar Bonds & NO symmetry

Ex H_2O



Polar Molecule → Polar Bonds & NO symmetry

Ex H_2O



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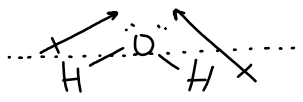

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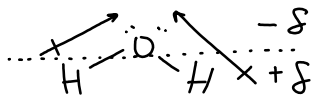

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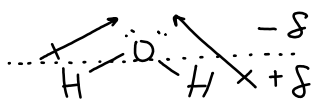
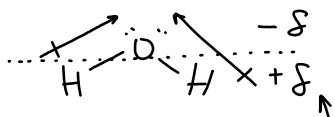


δ - delta
↳ partial charge

Polar Molecule → Polar Bonds & NO symmetry

Ex H_2O



δ - delta
↳ partial charge

↑ Polar molec b/c of 2 unequal opposite charges

Intermolecular Forces

Intermolecular Forces - attractive forces b/w molecules

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These are NOT Bonds

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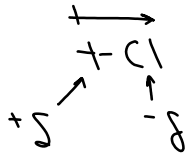
These are NOT Bonds

Dipole-Dipole Forces -

Intermolecular Forces - attractive forces b/w molecules

These are NOT Bonds

Dipole-Dipole Forces - Attractions b/w Polar Molecules



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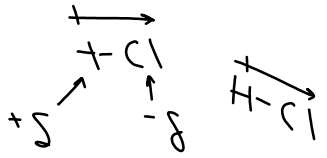
Dipole-Dipole Forces - Attractions b/w Polar Molecules



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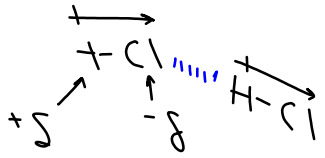
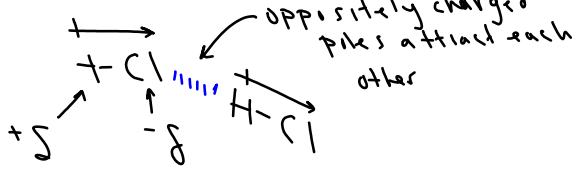


Intermolecular Forces - attractive forces b/w molecules

These are NOT Bonds

Dipole-Dipole Forces - Attractions b/w Polar Molecules

Attractions cause BP & FP ↑



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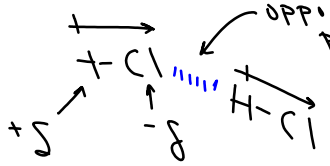

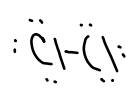

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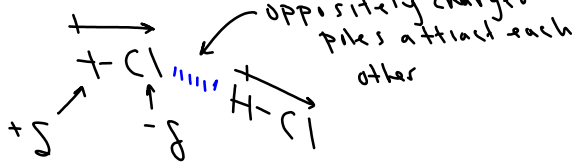
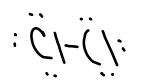




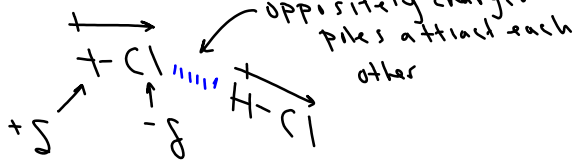
BP
-34.5°C

Intermolecular Forces - attractive forces b/w molecules

These are NOT Bonds

Dipole-Dipole Forces - Attractions b/w Polar Molecules

Attractions cause BP & FP ↑



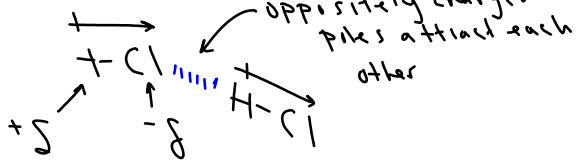
	BP
:Cl-Cl:	-34.5°C
:I-Cl:	

Intermolecular Forces - attractive forces b/w molecules

These are NOT Bonds

Dipole-Dipole Forces - Attractions b/w Polar Molecules

Attractions cause BP & FP ↑



	BP
Cl-Cl	-34.5°C
I-Cl	97°C

Hydrogen Bond. Strongest IMF

↳ Not Really a Bond

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↳ Not Really a Bond

↳ attraction b/w a H that is bonded to a strongly e- nrg element (N, O, F)

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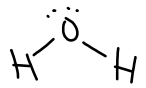
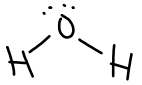


Hydrogen Bond. Strongest IMF

↳ Not Really a Bond

↳ attraction b/w a H that is bonded to a strongly e-neg element (N, O, F) and an unshared e⁻ pair on another atom



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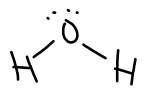

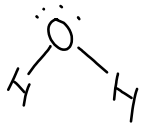

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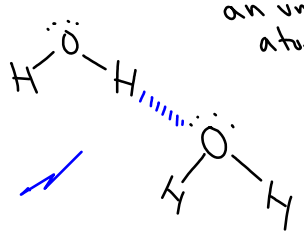

Hydrogen Bond. Strongest IMF

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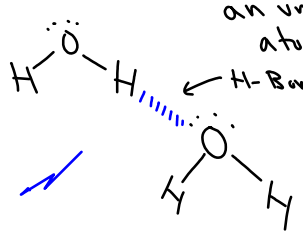
↳ attraction b/w a H that is bonded to a strongly e- neg element (N, O, F) and an unshared e⁻ pair on another atom

odd props of H_2O Bc of H-Bonds



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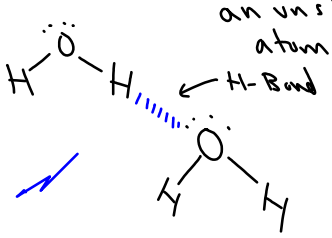

odd properties of H_2O b/c of H-Bonds

Water Beads ↑

meniscus (capillary action)

Hydrogen Bond. Strongest IMF

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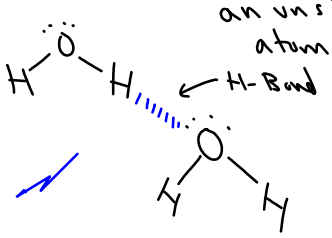
↳ attraction b/w a H that is bonded to a strongly e- neg element (N, O, F) and an unshared e⁻ pair on another atom



odd properties of H_2O b/c of H-Bonds

Water Beads ↑

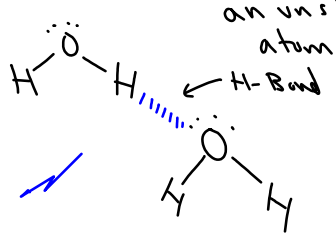
meniscus (capillary action)

Surface Tension

Hydrogen Bond. Strongest IMF

↳ Not Really a Bond

↳ attraction b/w a H that is bonded to a strongly e- nrg element (N, O, F) and an unshared e⁻ pair on another atom



odd properties of H2O
Bc of H-Bonds

Water Beads ↑
meniscus (capillary action)
Surface Tension
Ice is less Dense than liq.